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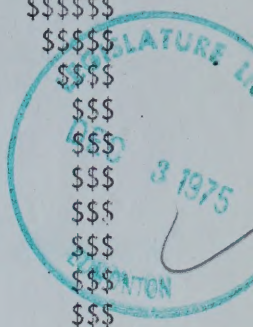

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

FOREST MANAGEMENT MANUAL

"To help perpetuate the proper use of the resources of the forested area of Alberta"

FOREST MANAGEMENT BRANCH

SEPTEMBER, 1966

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GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

Timber Management Branch

ALBERTA FOREST SERVICE

FOREST MANAGEMENT

THE HISTORY OF THE TIMBER DISPOSAL SYSTEM IN ALBERTA

CHAPTER 10

January, 1967

still in effect

FOREST MANAGEMENT

CHAPTER 10

THE HISTORY OF THE TIMBER DISPOSAL SYSTEM IN ALBERTA

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Department of Lands and Forests

Alberta Forest Service

FOREST MANAGEMENT CHAPTER 10

THE HISTORY OF THE TIMBER DISPOSAL SYSTEM IN ALBERTA

10.1 Introduction

This historical outline of timber disposal in Alberta breaks down into two major parts, with 1930 being the principle dividing year when the natural resources of Alberta were transferred from Federal to Provincial control.

10.2 The History of Federal Forest Control - 1870 to 1930

First of all, it seems strange in retrospect to find that almost all of western Canada, including Alberta as we know it today, was under the administration of a single commercial firm, the Hudson's Bay Company, for a period of 200 years; from 1670 to 1870. The Company was not only granted the right to trade for furs but also absolute territorial rights to colonize and govern the western territories. Because fur trading was its main purpose, the Company during this period not only discouraged colonization but even went so far as to take active measures to prevent settlement. The Confederation of Canada was declared in 1867 and three years later the Company surrendered its land rights to the new Government of Canada. The control of Crown lands and forests was vested in the Secretary of State in 1871 and transferred to the Department of Interior in 1873.

This Alberta region was first penetrated about 1750 by French explorers but it was not until the 1770's that white men became active in the area. The powerful Hudson's Bay Company and the North West Company competed bitterly for the fur trade with the Indians until the two companies merged in 1821.

The Methodists and Oblate priests are credited with establishing in this region in the 1840's but it was not until the decimation of the buffalo herds in the 1880's that ranching began on the southern plains.

The Homestead Act of 1875 made land available to colonists and the westward extension of the Canadian Pacific Railway to Calgary in 1883 facilitated settlement. In this same year, the North West Territories were divided into four postal districts, one being named Alberta by the Governor General of Canada.

The first recorded sales of Federal timber in the District of Alberta occurred in the period 1880 to 1884. For instance, some recent publications have referred to timber cut in the Burmis area of the Crowsnest Pass and hauled by ox team about 200 miles to Calgary in 1883; about the time of the arrival of the Canadian Pacific Railway which was under construction, a transcontinental railway, as a condition of confederation of the Governments of British Columbia and Canada. These timber sales were subject to the cost of survey, a ground rent of $2.00

per square mile per year and 5% royalty on the sales of products of each timber berth. This earliest disposal system was in the form of timber leases made under various conditions.

The Dominion Lands Act of 1879 provided for the yearly timber licensing system and its regulations dated March 8th, 1883 would appear to be the first which governed the granting of licences to cut timber on Dominion lands.

These regulations featured the following conditions:

(a) Area - limited to not more than 50 square miles;

(b) Ground Rent - annual charge payable in advance of $5.00 per square mile;

(c) Royalty - 5% on the sale of all forest products;

(d) Cutting system - all trees under 10" diameter were reserved to the Crown and those above 10" were authorized for removal;

(e) Sawmill - a minimum daily capacity of 10 M f.b.m. to operate at least six months of each year and to commence the sawmill operation within one year from a date to be fixed in the licence;

(f) Competition - in the event of two or more similar timber applications, the sale was awarded by bonus tendering.

On February 17th, 1885 the Department of the Interior discontinued granting of timber berths and all timber was to be disposed of only by public competition.

The policy of holding timber was discouraged because it was felt "while the non-operation of timber is satisfactory from the standpoint of conservation of forest wealth, yet the nation is entitled to its share of the increasing value of the country's timber resource."

The timber regulations were overhauled in 1889, and with few amendments, carried on for at least another 20 years with some features as follows:

(a) Royalty - 50 cents per M. f.b.m., 1 1/2 cents per railway tie and half rates for dead timber;

(b) Fire-Guarding Responsibility - one-half the cost incurred by the Crown for guarding the berth was defrayed by the licensee - one-half at this time amount to about $2.85 per square mile, which was simply derived by dividing the total Crown fire patrol expenditure of the prior year by the number of square miles held under licence;

(c) Ground Rent - payable in advance at the rate of $5.00 per square mile;

(d) Cutting system - a stump diameter of 10" was required but it is strange to note that for more than 30 years no stump height diameter was declared, thus the stump diameter was not practical nor enforceable.

(e) Special Operating Conditions - certain requirements were specified in the contract for the elimination of sawmill waste, the disposal of logging debris by piling rather than scattering, dealing with trespass - usually a penalty of double dues or $3.00 per tree - and provision was also made for the designation of seed trees to be reserved from cutting.

(f) Competition - all sales were offered by public auction with an upset price as the base.

(g) Renewal - the licences had yearly terms and were renewable "subject to the payment of such rental and dues and to such terms and conditions as are fixed by the regulations in force at the time the renewal is made."

From the beginning of the administration of Canada, one important policy was followed of allowing the homesteader to cut from Dominion lands, free of charge, such building and fencing material as he requires for his own use; and in addition, provision was made for the cutting of sawlogs, building logs, cordwood, ties, fence posts and poles upon the payment of dues. These privileges became known as timber permits, as distinct from timber licences, and were consolidated under regulations dated October 10th, 1881 and superseded by another set of regulations on May 24, 1886 with few minor revisions thereafter. This is the background of provincial public and school land timber permits. They have been known as Miscellaneous Timber Permits since August 1st, 1956 and are primarily designed to cover non-commercial operations under our provincial legislation. The Forest policy in the early years was therefore in favour of the farmer to open up new lands for settlement but even so, the forestry men of that time were aware of the need of protecting and managing the western forests.

To interject a local incident and an example of the intense past rivalry between the residents of Edmonton and the town of Strathcona on the south side of the Saskatchewan River, the story is recorded in June of 1892 of the Dominion Timber and Land Agent's attempt to move his office from Edmonton to Strathcona where it was reported he owned a significant amount of real estate. When he commenced to load the mover's wagon with government records, a crowd slowly gathered and soon determined the significance of the move. The crowd gradually became hostile and word of the proposed move spread down the streets like wildfire. Hostility turned into action when the angry crowd completely surrounded the moving wagon, unhitched the horses and even removed the wheels. Strathcona representatives next retreated to the south side of the river. The Agent then returned with two North West Mounted Police who only went so far as to confirm that Ottawa had approved the move. No further action resulted even though a Police troop from Fort Saskatchewan came to within a half mile of the scene. The Police Inspector came on alone but only to scan the scene and report to Ottawa that the disturbance had grown over the two days to the stature of a citizen's armed guard of over 500 strong! The end result was a gradual dissipation of the situation and finally the rescinding of the Agent's move by Ottawa.

The Dominion Forest Service was started in 1898 as a branch of the Department of the Interior. Before this, there had been some forestry organization in the eastern provinces but little had really been accomplished. The necessity for conservation of the western forest resources was further recognized by the appointment of an officer known as the Chief Inspector of Timber and Forestry in 1899.

This marks the real beginning of the Federal Forestry Branch which by 1960 was finally elevated to Federal department status. It is very evident that even before the days of the Federal Forestry Branch the timber regulations embodied the same principles which influence the administration of Crown timber today.

In each year of the early 1900's the Forest Branch of the Department of the Interior had at least six parties in the field examining lands in the Canadian west. The prime objectives were to determine the lands that control watersheds or delineate absolute forest lands which should be set aside for timber production. Thus the new service proceeded to inspect existing forest reserves, make suggestions for new ones and submit recommendations to improve protection from fire.

In 1902, the member of Parliament for the Edmonton constituency and founder of the "Edmonton Bulletin", Mr. Frank Oliver, became the Minister of Interior.

On September 1st, 1905, the District of Alberta, together with parts of adjacent areas was established as a Province. Thus, six most important events to Alberta, up to 1905, may be summarized as follows:

1. The transfer of the territories from the Hudson's Bay Company to the Confederation of Canada in 1870;
2. The retention of the natural resources by the Federal Government;
3. The building of the Canadian Pacific Railway to Calgary in 1883 and its extension to south Edmonton in 1902;
4. The great migration of settlers which began in earnest in 1897;
5. The formation of the Province on September 1st, 1905;
6. The arrival of the Canadian Northern Railway in Edmonton on November 23rd, 1905 on its westward march to the coast.

The year 1906 rates as highly important in the history of Canadian forestry for Parliament passed an Act respecting Forest Reserves which incorporated the three following policies:

1. The reserving of timber supplies;
2. The reserving of areas unsuited to agriculture so they would not be homesteaded; and
3. The preserving of the water level in streams by conserving the timber on the upper watersheds.

This placed the management and control of the Forest Reserves under the Forestry Branch, with provision for the making of regulations for their handling. At the same time, a large number of new reserves were created such as the Cooking Lake Forest Reserve, situated immediately south of the present Elk Island National Park. However, the licensed timber berths within the reserve boundaries were exempted from reserve regulations; thus this grave weakness in the legislation removed practically all the mature timber and all the logging operations from the application of forestry practice.

The Commission Conservation Report entitled "Forest Protection in Canada 1913-1914" advises there were no less than three separate branches of the Department of Interior administering timber, quoted in part as follows:

"As to timber berths, which comprise a very large percentage of the accessible merchantable timber on the public domain, both inside and outside forest reserves and Dominion parks, responsibility rests upon the Timber and Grazing Branch of the Department of Interior, which is, to a large extent, in practice a fiscal organization, charged with the collection of revenue, the prevention of trespass, the administration of grazing leases, etc.. This is due to the fact that legally, the licensed timber berths are not a part of the forest reserves or parks, even though included within their exterior boundaries. However, in the matter of establishing fire patrols, the whole forested portion of the public domain is covered by the organization of the Forestry and Parks Branches."

About this time in respect to field staff, there was only one inspector based in Calgary and six in Edmonton. Thus it was impossible to enforce the technical forestry provisions under such an establishment.

The Dominion government discontinued the practice of selling large tracts without a cruise which heretofore often resulted in the purchase of entire watersheds regardless of timber volume. Under the new policy, the application area had to be surveyed and cruised before it could be offered for sale. This policy continues to this day. Similarly, the practice of offering timber sales with special operating conditions to suit each individual sale area became established gradually rather than treating all sale areas identically. This method of selling timber was and still is a distinct advance over the initial licensing system, with its uniform regulations for all situations, since flexible authorization provided the insertion in each contract of special measures in the interests of the next crop.

In 1910, a detailed survey was carried out from the United States border to the North Saskatchewan River to determine the eastern boundary of the Rocky Mountains Forest Reserve. On May 19th, 1910, The Forest Reserves Act was replaced by Parliament by the Forest Reserve and Parks Act. This set aside 11,656,320 acres of reserves and parks in the Rocky Mountain area and five forests were created, namely Crowsnest, Bow River, Clearwater, Brazeau and Athabasca. A forest supervisor was placed in charge of each forest and ranger districts and fire patrols were organized within each forest. An intensive construction program was planned and carried out until 1918 to build 2,000 miles of trails and roads, 350 miles of telephone line, 20 ranger stations and 50 small cabins. In 1920, aircraft were used for the first time for fire patrol, first out of Morley then High River and later Embarras and Grande Prairie. The work by this early air service was rated as most valuable.

Licensed lands in Alberta in 1912 totalled 2,174 square miles and under permit 40 square miles, mainly along the North Saskatchewan, Athabasca and Peace Rivers and their tributaries.

The Commission of Conservation report of 1913-14 cites the first very rough forest inventory estimate at about 6 billion feet of spruce sawtimber. Today's sawtimber inventory figure is about 5 times the

figure of 50 odd years ago, however, at that time the net area of forest reserves alone was 19,473.15 square miles (comparing with 8,916 square miles today) with apparently another 14,000 square miles as possible additions. This then totalled about 33,500 square miles in present contrast to the 1960 forest zone of 135,020 square miles; that is, an increase of about 4 times.

The 1913-14 report on lumber production shows a total of about 50 million feet cut by 110 sawmills out of Calgary and Edmonton as compared to today's cut of 6 times larger. Dues approximated $1.50 per M. f.b.m. around 1913 and rose in 1922 to $3.00 per M. f.b.m. and 10 cents per tie.

The general policy governing timber disposal throughout Canada became very well established whereby rights to cut timber are granted but title to the forest land itself remains vested in the Crown.

10.3 The History of Provincial Forestry Control - 1930 and On

The next very important forestry change became effective on October 1st, 1930 when the natural resources were transferred to the control of the provincial government.

Under the constitutional laws of Canada, more accurately known as the British North America Act, it is clearly stated that the responsibility for the management of the natural resources is that of each of the provinces, with the single exception of the National Fisheries. The forests, of course, are amongst the most important of these resources.

Each Province of Canada, therefore, is free to decide on its own policies of forest management, to decide to what extent it wishes to hold the forest land as Crown or public land, to decide to what extent it wishes to accommodate the strong pressures for integrated and multiple uses of forest land, and to decide to what extent and manner it wishes to move toward sustained yield forest management.

As the fiscal year periods close on each March 31st, Alberta's first fiscal year of the new control, 1930-31, is represented in the matter of forestry expenditures by payments made in the latter half of that year. They amounted to $44,754.40 in salaries and $24,131.39 in expenses, comprising a total of $68,885.79. The last full year under Dominion Government control, 1929-30, expenditures were $185,642.66 salaries, $85,465.84 expenses, with total of $271,108.50. In the first full year under Alberta control, 1931-32, expenditures were salaries $118,343.58, expenses $42,657.52, total $161,001.10 of which $77,102.06 was charged to the east slope. This first year was marked by a bad fire season with large expenditures for fire suppression.

The first provincial forestry staff was recruited from personnel of the Dominion Forest Service and the Crown Timber and Grazing Branch who were already well acquainted with the Administration work and the forests. The Dominion retained an office in Calgary for research purposes.

The area coming under the new provincial organization comprised over 160,000 square miles with 12,000 square miles in the reserves and the balance of 148,000 square miles in the Edmonton Fire Ranging District.

In 1932 in the depression period, the need for economy resulted in the transfer of the Lesser Slave Lake Forest Reserve to the Northern Alberta Forest District and combining the Crowsnest with Bow River and also Athabasca with Brazeau. This eliminated 3 reserve offices and reduced the total of forest supervisors from 7 to 3. Rangers on permanent staff were reduced to 8 on the Forest Reserves while the Northern Alberta Forest District had only some seasonal rangers hired for 6 to 8 months per year and laid off in the winter. The situation only began to improve in 1941 and in 1943 all rangers were placed on permanent staff.

In 1943-44, Alberta passed the Dominion expenditure in its last full year of 1929-30 by spending a total of $291,327.50 of which $118,333.89 was spent on the east slope administration.

The provincial tree nursery at Oliver dates back to 1931 when it was established as an "activity" of the mental hospital. The next year produced over 8,000 spruce and pine seedlings and 700,000 caragana seedlings for distribution to farmers for shelterbelt purposes. Small nurseries were established at the Ponoka Mental Hospital and Fort Saskatchewan and Lethbridge jails and operated for a short period. The Oliver tree nursery was transferred to the Department of Agriculture in 1950 but it was not until 1959 when the Alberta Forest Service was again placed in a financial position to recommence artificial reforestation practices.

The year of 1948 was another very important year in the history of timber disposal in Alberta. First, the Crowsnest, Bow River and Clearwater Forest Reserves were placed under the Eastern Rockies Forest Conservation Board. Secondly, the Green and Yellow Zones were established with the following provincial government objectives:

1. To restrict settlement to those areas where social services are reasonably available;
2. To divide the forested area from the settlement zone; and
3. To reduce the danger of forest fires.

Alberta was thus divided into 2 major use zones, the South-east portion being the land settlement zone of about 35% of the total and the non-settlement green or forest zone mainly in the north amounting to about 65% in area. Since that time, settlement has been allowed in an orderly fashion on areas where soil surveys have indicated that farming is feasible.

With the increased activity in forestry, land, mining and soil, the old Department of Lands and Mines became overburdened thus it was split into 2 departments under Mines and Minerals and Lands and Forests in 1949. In that year also, the aerial photography and mapping contract was signed to produce various photographs, maps and forest inventory. Timber disposal from 1930 was administered under Timber Regulations of The Provincial Lands Act outside the Forest Reserves and under reserve legislation inside until 1949 when The Forests Act, 1949 was passed consolidating the disposal of all timber in Alberta under one authorization for the first time. The next revision was The Forests Act, 1961 assented to on April 12th, 1961 followed by the Forest Management Regulations dated September 18th, 1962.

10.3.1 Forest Management Units

The first forest management units and working plans in Alberta were initiated in the early 1920's, but serious fiscal cut backs and other reasons soon cancelled their development. The present forest management unit system got under way in the early 1950's together with a gradual but major alteration of Forest boundaries over the past 13 years.

The forested region of Alberta is now divided into eleven Forests to handle the administration responsibilities of The Alberta Forest Service. Each Forest has been further subdivided into management units which are established according to topography, access, continuity of timber, age class distribution, and vary in size from 1,500 square miles as in Management Unit S5 to 185 square miles as in the case of Management Unit B4. A management unit may be described as a timber administration unit which is managed as a separate entity on the basis of a sustained yield. It is understood of course that other uses occupy equal importance, and in the case of important snow pack and water yield regions, watershed is of prime importance. Each management unit is or will be controlled by a management plan. Such a plan outlines the timber use and includes such information as growing stock, allowable cuts, and a development program for the extraction of the timber resource.

Timber is a renewable resource which, if managed properly, will yield a continuous supply of raw material. As such, one of the basic purposes of management is to administer each management unit in such a manner that the volume may be cut periodically without disturbing the balance between forest growth and depletion or impairing the maintenance of the forest in perpetuity.

In essence, sustained yield forest management is now being successfully applied in Management Units on Forest Management lease areas and timber quota areas in Alberta.

10.3.2 Forest Management Leases

Under the authority of Section 6 of The Forests Act, 1961, the Minister, with the approval of the Lieutenant Governor in Council, may enter into an agreement with a person for a forest management lease for the manufacture of pulp, plywood or other products. To date, there are two active forest management lease areas - the 3,000 square mile area of North Western Pulp & Power Ltd. of Hinton (which may be expanded to over 6,000 square miles after mid-1968) and the 1,000 square mile area of North Canadian Forest Products Ltd. of Grande Prairie, a producer of coniferous plywood, lumber and chips. A third large lease area in the Whitecourt Forest held by MacMillan, Bloedel Ltd. is now in the planning stage and under the Agreement, construction is to start by January 1st, 1968. It is anticipated lease agreements will be made with two pulp companies in future in the Grande Prairie and Clearwater-Rocky Forests.

Briefly, a lease agreement grants the right to utilize and manage timber from Crown land on the basis of a sustained yield. The Department exercises control over lease holders through the requirements of management plans and annual operating plans. The Department has prepared guiding principles and ground rules for cutting practices for the lease areas of the two active leases.

The guiding principles and ground rules for cutting practices are designed to protect forest values by providing:

1. That no more than 50% of the area of merchantable timber shall be operated in any one cut. Arrangement of cut blocks, patches and strips to be cut over or reserved for other use or as a seed source shall be established to promote the establishment of natural regeneration of desirable species. A clear cut block or strip should not be over 10 chains in width or over thirty-five acres in spruce and 100 acres in pine.

2. Reserve timber shall be left for a distance of 5 chains of the high watermark of main watercourses and one chain of secondary watercourses or a greater distance if such is necessary to prevent soil erosion. Reserves of 300 feet are made on either side of numbered highways plus other specified secondary roads. Reserve timber of one chain shall be allowed to remain along the margin of intermittent streams. A five chain reserve strip shall be left around the margins of all resort lakes, and 2 chains around lakes other than resort lakes. A special map has been prepared classifying the watercourses into the foregoing categories.

   These ground rules also provide for proper road location and other aspects to ensure sound forest management practices.

Similar ground rules have been prepared governing all timber operations under licence in the Rocky Mountains Forest Reserve. These ground rules may be employed to manage and protect watershed values wherever their application is required in the Province. In addition, special operating conditions applicable to Timber Licences and Special Timber Permits are employed to ensure proper use and protection of forest values.

10.3.3 The History of the Alberta Timber Quota System of Timber Disposal

As to the development of the timber quota system, the late Honourable Norman Willmore in 1962 requested a thorough review of our timber disposal system and recommendations for improvement. The result was a plan to allocate timber quotas on a continuing basis in conjunction with the sustained yield capacity of each forest management unit somewhat similar to the system in effect in parts of British Columbia.

On November 20th, 1964, the Alberta Forest Products Association submitted a brief entitled "The Disposal of Crown Timber and Forest Tenure in Alberta". This brief was immediately studied by the Department and was found to be quite similar to the Department's proposals. The quota system plan was next submitted to the Provincial Cabinet who gave tentative approval in principle with certain conditions. The Director of Forestry then called a meeting on December 28th, 1964 attended by the Liaison Committee of the Alberta Forest Products Association and the Department personnel involved to go over the fundamentals of the timber quota system and to discuss some of the conversion problems. No publicity was to be released of the proposal to adopt this new system until formally approved by the Cabinet and the Minister had made an announcement to this effect in the Legislative Assembly in February. Minutes of this meeting plus a quota management unit map were prepared by the Department and distributed to all Association members.

The Forests Act, 1961 was amended on April 12th, 1965 to provide legislative authority for the timber quota system. This indeed was a milestone in the history of timber disposal in Alberta. The next legislative step was the approval by Order-in-Council of subsequent revisions to The Forest Management Regulations which became effective on May 1st, 1966.

This latter step finally implemented the coniferous timber quota system. The next stage was the drafting of a proposed deciduous timber quota system which is being completed at the time of writing this particular Forest Management Chapter; accordingly, this phase when approved will complete the introduction of the timber quota system in Alberta.

Brief mention should be made to certain stages of the development of the coniferous timber quota system relative to both field and office activities. A "crash" program was undertaken by the Alberta Forest Service commencing in February of 1965 to complete reconnaissance cruises and compilation of priority management units in order to establish quotas for allocation or sale. This important phase was completed for the majority of Alberta's 106 forest management units within 1 1/2 years. Much of the success in this endeavour has to be attributed to the advantageous use of helicopters and good work plans.

Coniferous timber quota sales were first offered for competition at Head Office on June 14th, 1966, namely F8-Q1 for 7 MM f.b.m., F8-Q2 for 7 MM f.b.m., F8-Q3 for 6.8 MM f.b.m. and F8-Q4 for 1.5 MM f.b.m. The foregoing are samples to emphasize the fact that surplus allowable cuts were determined for a significant number of the more accessible Management Units in the northern Forests. In other Management Units which were mainly located in the west and southern parts of the Province, quotas were granted to qualified licensees in volumes based on past annual production averaged over the April 1st, 1960 to March 31st, 1964 period and adjusted to the calculated sustained yield capacity of each unit. The final step was the issuance of Form FM 10 - Timber Quota Certificate - by which authority the quota holder is granted successive timber licences with controlled volumes at appraised rates of dues.

A summation of the allocation of earned and purchased quotas by Timber Quota Certificates up to December 1st, 1966 follows:-

Feet Board Measure Volume Class	F.B.M. No. of Quotas	Percentage
0.1 MM f.b.m.	37	
0.2	12	
0.3	14	
0.4	12	
0.5	8	
Total 0.1 to 0.5 MM class	83	39.5
0.6 to 1.0	21	
1.1 to 1.5	16	
1.6 to 2.0	14	
2.0 to 2.5	13	
Total 0.6 to 2.5 MM class	64	30.5
2.6 to 3.0	9	
3.1 to 4.0	15	
4.1 to 5.0	16	
Total 2.6 to 5.0 MM class	40	19.0
5.1 to 7.5	16	
Total 5.1 to 7.5 MM class	16	7.6
7.6 to 10.0	6	
Total 7.6 to 10.0 MM class	6	3.0
10.1 and over	1	
Total 10.1 MM and over class	1	0.4
Grand Total	210	100.0 %

Several significant observations may be taken from the foregoing tabulation, one of the most important economic-wise being the fact that 147 or 70% of the quotas are within the 0.1 to 2.5 MM f.b.m. class. It therefore appears obvious that many of these quotas will probably be combined through assignments within the first 5 year quota period to achieve more practical operations and fewer in number. There are only 119 quota holders so far.

To complete the above timber quota picture, it should be explained that 16 of the above f.b.m. quotas also have allocations for round timbers measured in terms of lineal feet. There are 9 quotas issued in terms of lineal feet only.

The total quota volume amounts to 437.9 MM f.b.m. and 11.2 MM lineal feet to date. This compares well with our average annual production for the year 1962 to 1966 of 379 MM f.b.m. comprising lumber and plywood only.

In summary the new Alberta Timber Quota System will allow the holders of Timber Quota Certificates to plan their operations on a long term basis which should result in better road systems, larger and more efficient mills and better utilization. In other words, the introduction of the timber quota system makes for practical application of sustained forest management which in turn provides for continuous and regular forest production, premanency of the forest industry and dependent communities. The end result is the enhancement of direct and indirect social benefits on a local, provincial and a national scale.

10.4 The Forest Management Policy of the Alberta Forest Service

The primary objective of the Alberta Forest Service is the continuous production of timber supplies and the retention and establishment of forest cover. In so far as may be consistent with the foregoing objective, the other resources and potentialities of the forest are to be developed to the fullest extent. The Forests Act, 1961, Chapter 32, and the regulations thereunder provides the authority and procedure for the management of Crown timber.

Accordingly, the sale and cutting of timber should be permitted only at such times and places and under such conditions as will safeguard and advance the above objectives. The silvicultural treatment of the forest will vary according to whether timber production, water conservation, soil protection, recreation or other use is considered of most importance. In almost every case, it will be possible to meet the requirements of all uses to a satisfactory degree without any serious concession in any. The production of timber supplies is nevertheless of paramount importance except where there is a well defined need for water and soil protection, special land or recreational use.

This type of management, commonly called sustained yield management, strives to ensure that resources will be utilized in a rational manner, without undue waste. Since it is just as wasteful to allow our renewable resources to go unutilized as it is to over-utilize them, continuous regular production is a requisite and provision is also required for maintenance and re-establishment of a forest crop. In short, our forests are a renewable resource.

There is a fundamental distinction of rights granted under The Forests Act and The Public Lands Act. The Department is gradually amending and enforcing the subsequent regulations. In essence, legislation under the former Act governs timber cropping and the latter the special uses of land.

Accordingly, the April 12th, 1965 amendments to The Forests Act, 1961 now conform whereby Section 10 allows the timber disposition holder the right to enter and occupy the land for the purpose of removing timber and regenerating the timber resource. He does not have any rights to the land per se. This provision exists because of the Department's policy whereby the multiple-use of land for the development of natural resources is to be encouraged.

In summary, the basic function of the Alberta Forest Service is to help perpetuate the proper uses of the resources of the forested area of Alberta.

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TIMBER MANAGEMENT

WEIGHT SCALING

CHAPTER 11

OCTOBER 1973

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INTRODUCTION TO SCALING

The measurement of logs to ascertain their contents is called scaling. Scaling is not a guess but a scientific estimate based on certain fundamental rules tempered with experience.

Although there are various purposes for scaling, the main purpose of scaling is to measure the volume of the forest product being sold.

There are three general scaling methods used in Alberta:

A. By Board foot measure [International 5/16 Inch Log Rule].

B. Solid volume, the unit of measure being the cubic foot. [Alberta Cubic Foot Rule, Cubed Pulpwood Instructions].

C. Apparent volume, the unit of measure being the cord of 128 apparent cubic feet, or the equivalent of a pile of wood 4 feet x 4 feet x 8 feet. [Pulpwood Instructions – stacked wood].

Scaling of wood by weight is a sampling procedure relating the scaled volume of sample loads in relation to the total weight of all loads.

REQUIREMENTS OF A SCALER

When scaling or measuring Crown timber a scaler is determining the amount of government property passing into private ownership and the amount of revenue from the sale of that property. It is his duty, holding an Alberta licence or permit to scale and being responsible to the Department, to determine these amounts fairly and accurately.

Scaling, as practised by the Department, is a measurement related to the quantity of sound merchantable wood rather than the quality. It is therefore the scaler's duty to scale in accordance with the volume of a certain product and not in relation to any particular grade of material that is produced.

The scaler must have sound and impartial judgement, confidence in that judgement and an ability to withstand negative opinions, except when accompanied by substantial evidence. The scaler must base his judgement on a thorough understanding of the following factors:

A. The scaling rules and regulations governing scaling practices in the Province of Alberta.

B. In addition to being familiar with the basic procedures for scaling a scaler must be aware of any agreement stipulation that may appear in contract between the Department and a company and how they may be co–ordinated with the basic scaling procedures.

C. The defect characteristics of the different species in the area.

D. The defect characteristics of trees taken from different sites within the area. Both mechanical and pathological defects vary with the difference in sites.

E. The identification of the different trees species in the area.

Time alone does not make a scaler qualified. His training must be thorough and the results of his work accurately checked. A scaler must at all times realize that he is the Department's representative on the operation and it is his duty to report all matters of interest to the district Forest Officer. This includes matters other than scaling.

ASSURANCE TO PURCHASERS

No assurance regarding Departmental scale will be made to purchasers, except that provincial timber will be scaled in accordance with instructions for scaling, without modification because of the favourable or unfavourable market conditions or other factors which may influence the amount of recovery or even prevent the manufacture of the amounts scaled. Every effort will be made to keep the scaling practice uniform.

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NOTE: Form TM 35 reduced in size for illustration.

Form TM 3

WEIGHT SCALE—LOAD RECORD SHEET

Month December, , 19 72 Licence or Population F1-L13 Scale Location High Prairie Sheet Number 1

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
3	1	143484W	47660
4	2	143485W	50480
	3	143486W	58360
5	4	143487W	54080
	5	143488W	45680
	6	143489W	51360
6	7	143490W	52220
	8	143491W	47300
	9	143551W	33[illegible]
	10	143492W	[illegible]
8	11	143[illegible]W	3[illegible]40
9	12	143493W	5[illegible]760
	13	143[illegible]94W	54[illegible]80
	14	143495W	49[illegible]0
11	15	143496W	52[illegible]0
	16	143[illegible]97W	50[illegible]0
	17	143[illegible]98W	50580
16	18	143499W	42660
	19	143500W	52500
	20	102801V	55340
17	21	102802V	36920
	22	102803V	45320
	23	102804V	49700
	24	102805V	49520
	25	102806V	42060
	TOTAL No. 1		1209630

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
18	26	102807V	46520
19	27	102808V	54820
	TOTAL No. 2		101340

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
	TOTAL No. 3		

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
	TOTAL No. 4		

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11.1

WEIGHT SCALING PROCEDURES

11.1.1

INITIATION OF WEIGHT SCALING

Prior to establishing a system of weight scaling for the payment of dues the Forest Service must receive a letter of application outlining the intentions of the purchaser.

11.1.2

WEIGHING OF THE WOOD

11.1.2.1

WEIGHT SCALE SPECIFICATIONS

[1] The company will be responsible for installation and maintenance of the weight scale, cabin and fixtures. There are several firms which sell or rent and service weight scales and these agents are able to give technical advise with respect to size and kind of scale best suited for the job. Costs of scales range from $20,000 to $24,000 installed. Suppliers of scales can be located by referring to the telephone directory.

[2] Platform scales capable of simultaneously weighing all axles for a full length logging truck are required in weighing for the payment of dues. Usually scales between 10 inches x 60 inches [highway hauling] and 12 inches x 70 inches [off highway hauling] in size with a capability of 100 tons are suitable. Portable scales are acceptable for use only if adequate footings are provided as specified by Dominion Weights and Measures Services.

[3] Scales must be equipped with an automatic printing attachment. It is preferable if the attachment is capable of printing on the forest products Form F/M 9 as this reduces time and possibility of error.

[4] The weight scale should be positioned so that the trucks can be weighed loaded and immediately after unloading. Prior to purchasing or installing a scale the Dominion Weights and Measures Service should be consulted regarding approval of various types of scales and installations.

[5] Weight scale cabins must be of sufficient size [minimum 100 sq. ft.] and be equipped with adequate facilities [heating, lighting, writing and filing space] so that the scaler may carry out his duties. Such facilities will be subject to approval before a weight scale is accepted.

11.1.2.2

WEIGHING PROCEDURES

All loads must be weighed when entering the yard and the trucks re-weighed immediately after unloading. The weight of the wood is then obtained as follows:

Weight of loaded truck - weight of empty truck =weight of wood [lbs. or tons]

11.1.2.3

INFORMATION FOR WEIGHT SCALE OPERATORS

This information is intended as a guideline for checking practices to ensure that the scale is weighing satisfactory at all times and to prevent any malfunction which may result in loss of time and money for everyone concerned. It may be pointed out however that any adjustments to printer or weighing mechanism should be left to qualified persons.

[1] Scale locking handle should always be in its locked position when scale is not in use and when vehicles are in motion either coming on to or leaving the platform. The only time the scale should be unlocked is during the actual weighing process.

[2] For scales with dial indicating mechanisms, range change handle where practical should be left in the range position where weighing normally takes place. This will minimize shock loading and assist operator to speed up weight cycle time.

[3] The scale should be balanced to zero frequently, especially in weather conditions which influence the weight of the deck. Balancing procedures for individual scales can be obtained from distributors and should be kept on hand at all times. As adjustments can only be made to counteract a small amount of weight, excessive snow and mud should be cleared from the deck.

[4] The operator should check periodically to ensure that the platform is free and not binding against the sides of the pits. Stones or other foreign objects should be removed or driven through to the pit, if they are found to cause binding.

[5] The operator should remain on the lookout for unreasonable values indicating that something has gone wrong with the scale. By being familiar with average truck weight and average load weight, he should easily spot readings of dubious value. On dial scales with automatic printers, printed weight should correspond closely to dial reading. If the printer and dial do not correspond, dial readings should be hand written along side the printed figure until a check is made by a qualified person.

[6] In winter, the operator should watch for water freezing on the mechanism, which is a common source of trouble. This will usually result in significantly lower recorded weights than normal.

[7] The operator can make a rough check on the scale by weighing a car or other vehicle at four different locations [above each lever system] on the platform. If the four readings agree, probably nothing is wrong.

[8] If the operator suspects that something is wrong he should inform everyone concerned [owner and Forest Service] as soon as possible.

11.13

MEASUREMENT OF THE SAMPLES

11.1.3.1

IDENTIFICATION OF WOOD

Unless otherwise authorized, all loads must be accompanied by a completed Forest Products Form T/M 9. In addition two or more logs on the load must be marked prior to leaving the timber licence, designating that particular licence unless otherwise authorized. It is necessary to have positive identification of source so that wood from each particular licence may be accounted for separately, due to the different appraised value for each licence.

It is to the advantage of all parties that wood be presented as soon as possible after cutting in order to prevent fluctuations due to moisture loss. If wood has been cut for a period exceeding six months, this wood should be considered separately in sampling.

11.1.3.2

SAMPLE SELECTION

Loads from each licence are numbered in series from the beginning of each timber year [May 1]. As the loads arrive at the scale the load number is designated.

Choice of the sample load is made at random and no one should know whether a load is to be scaled or not until the time it arrives at the scaling point. Predetermined random numbers for selection of sample loads will be supplied by the Department unless otherwise authorized. The sample load will be selected at random within a group. For example, at the beginning of sampling when a 10% sample is required; one load at random from each group of 10 or ten loads at random from each group of 100 may be used.

After 30 sample loads have been collected from any one licence, the data may be analyzed by the Department and the frequency of sampling may be reduced depending of course on how variable the timber is.

Once sufficient experience has been gained intensity of sampling may be judged from past data. The minimum sampling in any case will not be less than 1% [one load per one hundred] or a minimum of 30 samples on any particular area.

11.1.3.3

SCALING OF THE SAMPLES

The selected sample loads are to be bucked and scaled according to one of the following scaling instructions.

[a] Scaling instructions for cubed pulpwood [FM Chapter 24]

[b] Scaling instructions for Saw and Peeler Logs [FM Chapter 21]

[c] Alberta Cubic Foot Scale [FM Chapter 25]

Logs should be presented to the scaler in a manner that allows him to examine each log thoroughly.

It is preferable that a scaling yard be established near the scale so that several sample loads may be accumulated and spread out for scaling at any one time. The scaler may then be able to weigh the loads and scale the samples during slack periods.

In order to be successful it must be recognized that the system demands the maintenance of a high standard of scaling proficiency. It is therefore necessary that sampling will be done by a licenced scaler or by permit scalers under the supervision of a licensed scaler unless otherwise authorized by the Director.

Periodic check scales will be made by the Forest Service. However, as it is not the intention of the Service to check scale all the loads a random system for check scaling is desirable. The four most recently scaled loads must be maintained on hand unless otherwise advised.

As balsam fir is a lesser rate of dues than spruce and pine it is sometimes desirable to segregate the volume of balsam fir. This may be done by scaling the species separately in the sample loads and arriving at scale estimate for that species as shown under Section 11.1.4.

11.1.4

ACCOUNTING OF LOADS AND CALCULATING SCALE ESTIMATE

This method employs the use of two forms:

[a] Form TM 44 – weight scale sample ledger and volume compilation sheet.

[b] Form TM 35 – weight scale load record sheet.

The above forms are produced on self-carbon paper in triplicate. It is intended that one copy be maintained for operators use, while the remaining two copies, which is intended for Forest Service information, should be forwarded to check scaler or District Forest Officer.

11.1.4.1

ACCOUNTING OF LOADS [Form TM 35]

All licences should be considered separately for accounting of weight. This applies even in cases where sample loads are grouped and a common calculating base is applied. [i.e. Figure 1]

A Form TM 35 [load record sheet] is used for each source per month. If more than one sheet is required as when several hundred loads are hauled from any one source, the sheet may be numbered [i.e. Sheet No. 1, 2, 3, etc.].

Loads from each licence are numbered from the beginning of each timber year.

FIGURE 2

Example of a completed Load Record Sheet (TM 35) on which all weighed loads for licence F1-L13 are listed for month January 1972.

NOTE: Form TM 35 reduced in size for illustration.

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Form TM 35

WEIGHT SCALE—LOAD RECORD SHEET

Month January, 1972 Licence or Population F1 - L13 Scale Location High Prairie Sheet Number 1

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
3	28	102809V	48480												
	29	102810V	52280												
	(30)	102811V	52020												
	31	102812V	56920												
4	32	102813V	50380												
	33	102814V	61220												
5	34	102815V	55860												
	35	102216V	64620												
	(36)	102817V	72860												
6	37	102818V	59400												
	38	102819V	65600												
	39	102820V	59760												
	40	102821V	69360												

TOTAL No. 1 768760 TOTAL No. 2 TOTAL No. 3 TOTAL No. 4

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i.e.

Figure No. 1 [F1–L13] Month of December/69 – loads 1 to 27

Figure No. 2 [F1-L13] Month of January /70 – loads 28 to 40

During the month the net weight of each load along with the Form 9 number is listed consecutively according to load number.

A total is obtained for each column of weight. [Refer to Figure No. 1 and note totals of 1,209,630 and 101,340].

This total is then carried and summarized on the 'Summary of Weights' column on Form TM 44 [volume compilation sheet]. [Refer to Figure No. 3 and note transfer of totals from TM 35 of Figure No. 1].

11.1.4.2

CALCULATING OF SCALE ESTIMATE [Form TM 44]

The Sample ledger section of Form TM 44 is used for accumulating the sample data. The forms are compiled monthly, using the accumulation of sample load net weights, sample load net scales and total weight to obtain the scale estimate. Data is compiled using information beginning each timber year [May 1] and accumulated for the year. Populations for calculating the scale estimate may be considered as follows:

[a] As an individual licence [Figure 3 and 4].

Segregation by licence may be required where several large licences of varying nature are being operated.

[b] As two or more licences combined [Figures 5 and 7].

Where several small licences of similar characteristics are being sampled, it may be advantageous to group the samples of two or more licences in order to obtain a common calculation base. It should be kept in mind that at least 30 samples are considered as a minimum from any one population.

[c] As portion of a licence.

It may be desirable for operators to segregate by contractor or area especially if conditions vary within a licence.

11.1.4.2.1

CALCULATION OF SCALE ESTIMATE [Individual Licence]

The following steps are taken in calculating a scale estimate [Figures 3, and Figure 4] on the Form TM 44.

Line No. 1

All the net weights and net scales from the sample loads are listed each month and totals of the net weights and net scales are entered in appropriate columns of Line No. 1. It may be noted that Balsam Fir may be scaled and listed separately if so desired. Weight summaries [transfered from TM 35] are also totaled to give total wood weight for the month.

Line No. 2

As the calculations are based on the accumulated totals it is necessary to bring the totals from the previous month forward. In figure No. 3 it is assumed that December is the starting month for F1-L13, therefore no entry is required in Line No. 2. However, it may be noted that the entries of Line No. 3 of December in Figure 1 are carried to Line No. 2 of January in Figure No. 4, and thus included in the following months calculations.

Line No. 3

The present totals [Line No. 1] are added to the past assumulated totals [Line No. 2] in order to arrive at a new accumulated total which may be used for calculating.

Line No. 4

At this point one of two methods of calculating could be used; however, to reduce the number of calculations the second method is used on the TM 44.

Weight Scale Formula:

$$\frac{\text{Sample Weight}}{\text{Sample Scale}} = \frac{\text{Total Weight}}{\text{Scale Estimate}}$$

Method No. 1:

$$\frac{\text{Sample Weight}}{\text{Sample Scale}} = \text{Ratio [conversion factor]}$$

$$\frac{\text{Ratio}}{1} = \frac{\text{Total Weight}}{\text{Scale Estimate}}$$

$$\text{Thus Scale Estimate} = \frac{\text{Total Weight}}{\text{Ratio}}$$

Method No. 2:

$$\text{Sample Weight [B]} \times \text{Scale Estimate} = \text{Total Weight [A]} \times \text{Sample Scale [C]}$$

$$\text{Thus Scale Estimate} = \frac{\text{Total Weight [A]} \times \text{Sample Scale [C]}}{\text{Sample Weight [B]}}$$

Line 4 is used for the scale estimate [converted volume] for pine and spruce if scaling is done in F.B.M. or for class B material if scaling is done in terms of cubic feet. For calculating purposes three additional zeros should be added to the total weight. This results in an answer with three decimal places to be carried through the calculation. The final converted volume may then be rounded to a whole number for entry on line No. 4.

Line No. 5

This line is used for calculation of the Balsam Fir volume in cases where measurement is in terms of

Figure 3

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Form TM

WEIGHT SCALE

Sample Ledger and Volume Compilation Sheet

Licence F1-613 Scale Location High Prairie Month December, 19

Contractor or Vendor Company Company Slave Lake Lumber

SUMMARY OF WEIGHTS (From Load Record Sheets)			SAMPLE LOAD LEDGER			
					Net Scales (Designate Species or Class in Spaces Belo	
Sheet No.	Total No.	Total Net Weight	Sample Load No.	Net Weight	SW+PL	Balsam Fir
1	1	1209630	6	51860	5001	556
	2	101340	14	46280	4681	246
	3					
	4					
2	1					
	2					
	3					
	4					
3	1					
	2					
	3					
	4					
4	1					
	2					
	3					
	4					
5	1					
	2					
	3					
	4					
6	1					
	2					
	3					
	4					
7	1					
	2					
	3					
	4					

LINE NO.						
1	This Months TOTALS.....	1310970		98140	9682	802
2	Last Mths Accumulated Totals (from last mths Line No. 3!)	–		–	–	–
3	This Mths Accumulated Totals (Line No. 1 + Line No. 2)	A 1310970	B	98140	C 9682 D	802 E
4	SW+PL — Total Converted Volume (A÷B)×C= (Take A÷B to 3 decimal places)				129300	(Round Off Converted Vo Nearest 10C Fbm. or 10
5	Balsam Fir — Total Converted Volume (A÷B)×D=					10700
6	____ — Total Converted Volume (A÷B)×E=					
7	Last Months Converted Volumes = (from line Nos. 4, 5 or 6 of last months sheet)				–	–
8	This Months Volume = (Line Nos. 4, 5 or 6 minus Line No. 7)				129300	10700
9	Indicate Unit of Measure Used Under Column by Marking Square				Fbm. ✓ Cuft.	Fbm. ✓ Cuft.	Fbm.

THIS SECTION FOR THE USE OF ALBERTA FOREST SERVICE

For Sample Scale/Sample Weight Ratio: — Divide Accumulated Sample Net Weight by Accumulated Sample Scales (three decimal places)

Ratio (Line 3) = B÷(C+D+E)..... 9.361

Total No. of Loads Weighed This Month.. 27

Inspected by Forest Officer _____

Date _____

COPY FOR: LESSEE/LICENSEE/PERMITTEE

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Figure 4

Alberta
LANDS AND FORESTS

WEIGHT SCALE

Sample Ledger and Volume Compilation Sheet

Form TM-

Licence E1 - 413 Scale Location High Prairie Month January, 1973

Contractor or Vendor Company Company Slave Lake Lumber

SUMMARY OF WEIGHTS (From Load Record Sheets)			SAMPLE LOAD LEDGER			
					Net Scales (Designate Species or Class in Spaces Belo	
Sheet No.	Total No.	Total Net Weight	Sample Load No.	Net Weight	SW + PL	Balsam Fir
1	1	768760	30	52020	5542	54
	2		36	72860	7343	340
	3					
	4					
2	1					
	2					
	3					
	4					
3	1					
	2					
	3					
	4					
4	1					
	2					
	3					
	4					
5	1					
	2					
	3					
	4					
6	1					
	2					
	3					
	4					
7	1					
	2					
	3					
	4					

LINE NO.						
1	This Months TOTALS	768760		124880	12885	394
2	Last Mths Accumulated Totals (from last mths Line No. 3!)	1310970		98140	9682	802
3	This Mths Accumulated Totals (Line No.1 + Line No. 2)	A 2079730	B	223020 C	22567 D	1196 E
4	SW + PL — Total Converted Volume (A÷B)xC= (Take A÷B to 3 decimal places)				210400	(Round Off Converted Vo Nearest 100 Fbm. or 10
5	Balsam Fir — Total Converted Volume (A÷B)xD=					1200
6	____ — Total Converted Volume (A÷B)xE=					
7	Last Months Converted Volumes = (from line Nos. 4, 5 or 6 of last months sheet)				129300	10700
8	This Months Volume = (Line Nos. 4, 5 or 6 minus Line No. 7)				81100	400

9 Indicate Unit of Measure Used Under Column by Marking Square..... Fbm. ✓ Cu.ft. | Fbm. ✓ Cu.ft. | Fbm.

THIS SECTION FOR THE USE OF ALBERTA FOREST SERVICE

For Sample Scale/Sample Weight Ratio = Divide Accumulated Sample Net Weight by Accumulated Sample Scales (three decimal places)

Ratio (Line 3) = B÷(C+D+E)..... 9.385

Total No. of Loads Weighed This Month 13

Inspected by Forest Officer _____

Date _____

COPY FOR: LESSEE/LICENSEE/PERMITEE

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F.B.M. If measurement is in cubic [illegible] then this line may be used to calculate class C material.

Calculation procedure is the same as outlined for line No. 4.

Line No. 6

This line may be used to calculate any other species or class of data which is not included in lines 4 or 5.

Line No. 7

As lines No. 4, 5, and 6 are based upon accumulated data the converted volumes includes all past data. In order to arrive at a volume calculation for a month. The converted volume [lines 4, 5, and 6] from the past month is entered in line No. 7. If no information was calculated for the previous month as in the case of the first month [Refer to Figure 3] then no entries are made.

Line No. 8

This line is the result of subtracting line No. 7 from lines No. 4, 5, and 6, being the calculated volume for the month.

These volumes are submitted as the weight scale volumes on monthly timber returns [Form TM 7].

11.1.4.2.2

CALCULATION OF SCALE ESTIMATE [Combined Data]

When the scale estimate is being calculated for combined licences [Figure 5, 6, and 7] the weights are listed on separate forms TM 35.

Sample loads are selected from each of the licences on the same frequency basis. The sample load data is then grouped together in the TM 44 sample load ledger. The sum of the sample loads will then give a common data base from which the scale estimate may be calculated.

A final separate calculation is made for each licence, applying the weight from the Form TM 35 to the common data base in order to arrive at the scale estimate for each licence.

The objective of combining licence data is to obtain sufficient data [30 samples] without increasing the sampling intensity to a unbearable level. It should be remembered, however, that licences should contain timber of a similar characteristic before combining can be considered.

11.1.4.3

PURCHASED WOOD

Whenever wood in log form is being purchased from a licence or permit by an operator with a weight scale, the following will apply:

[1] The purchaser will be responsible for the weighing, and recording of weights.

[2] Samples will be selected and scaled in the same manner as prescribed for weight scaling. Unless other arrangements are defined it will be assumed that scaling responsibility lies with the purchaser.

[3] Records of weights [Form TM 35] and calculations [Form TM 44] will be supplied to the vendor and to the Forest Service.

[4] The vendor will be considered responsible for the submission of returns [Form TM 7] and the payment of dues unless special arrangements are made to the contrary.

Figure 5

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LANDS AND FORESTS

WEIGHT SCALE
Sample Ledger and Volume Compilation Sheet

Licence R12-L12 (Part A) Scale Location Smith Month December, 19

Contractor or Vendor Contractor "A" Company Smith Logging

Population "A"
A - R12-L12 Contractor "A"
B - R12-L12 Contractor "B"
C - R12-L11

SUMMARY OF WEIGHTS (From Load Record Sheets)			SAMPLE LOAD LEDGER		
Sheet No.	Total No.	Total Net Weight	Sample Load No.	Net Weight	Net Scales (Designate Species or Class in Spaces Be) SW+PL
1	1	1243160	A-6	68720	8377
	2	2157360	B-5	54420	5531
	3		C-5	62460	6694
	4		B-12	49360	4341
2	1		B-21	62860	6575
	2				
	3				
	4				
3	1				
	2				
	3				
	4				
4	1				
	2				
	3				
	4				
5	1				
	2				
	3				
	4				
6	1				
	2				
	3				
	4				
7	1				
	2				
	3				
	4				

LINE NO.						
1	This Months TOTALS.....		3400520		297820	31518
2	Last Mths Accumulated Totals (from last mths Line No. 3!)		–		–	–
3	This Mths Accumulated Totals (Line No.1 + Line No. 2)	A	3400520	B	297820	C 31518 D E
4	SW+PL — Total Converted Volume (A÷B)×C= (Take A÷B to 3 decimal places)					359900 (Round Off Converted V Nearest 100 Fbm. or I
5	— Total Converted Volume (A÷B)×D=.....					
6	— Total Converted Volume (A÷B)×E=.....					
7	Last Months Converted Volumes = (from line Nos. 4, 5 or 6 of last months sheet).....					–
8	This Months Volume = (Line Nos. 4, 5 or 6 minus Line No.7).....					359900
9	Indicate Unit of Measure Used Under Column by Marking Square.....					Fbm ✓ Cu.Ft. Fbm. Cu.Ft. Fbm.

THIS SECTION FOR THE USE OF ALBERTA FOREST SERVICE

For Sample Scale/Sample Weight Ratio — Divide Accumulated Sample Net Weight by Accumulated Sample Scales (three decimal places)

Ratio (Line 3) = B÷(C+D+E)..... 9.449

Total No. of Loads Weighed This Month.. 57

Inspected by Forest Officer _____

Date _____

COPY FOR: LESSEE/LICENSEE/PERMITTEE

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NOTE: Form TM 35 reduced in size for illustration.

Form TM 35

WEIGHT SCALE—LOAD RECORD SHEET

Month December, 1970 Licence or Population (A) R12-L12 (Contractor B) Scale Location Smith Sheet Number 1

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
12	1	103756V	55400
12	2	103787V	62960
	3	103788V	60440
	4	103789V	57500
		103790V	54620
14		103791V	50800
	7	103792V	50680
		103793V	5 360
	9	103794V	52 640
16		103795V	54 [illegible]
17		[illegible]96V	49680
18		[illegible]797V	43360
		103798V	56740
		103799V	53540
		[illegible]800V	51260
	16	20851A	52 [illegible]0
	17	20852A	61060
	18	20853A	52460
	19	20854A	58100
	20	20855A	49800
23	21	20856A	62860
	22	20857A	57720
	23	20858A	51540
	24	20859A	52420
	25	20860A	58080

TOTAL No. 1 1377840

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT
23	26	20861A	56920
	27	20862A	44640

TOTAL No. 2 101560

TOTAL No. 3

DAY	LOAD NUMBER	FORM 9 NUMBER	NET WEIGHT

TOTAL No. 4

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LANDS AND FORESTS

Form TM 44

WEIGHT SCALE

Sample Ledger and Volume Compilation Sheet

Licence R12-L12 (Part B) Scale Location Smith Month December, 1970

Contractor or Vendor Contractor "B" Division Smith Logging

SUMMARY OF WEIGHTS (From Load Record Sheets)

Sheet No.	Total No.	Total Net Weight
1	1	
	2	
	3	
	4	
2	1	
	2	
	3	
	4	
3	1	
	2	
	3	
	4	
4	1	
	2	
	3	
	4	
5	1	
	2	
	3	
	4	
6	1	
	2	
	3	
	4	
7	1	
	2	
	3	
	4	

SAMPLE LOAD LEDGER

Sample Load No.	Net Weight	Net Scales (Designate Species or Class in Spaces Below) Sw & Pl

(Continue Base From R12-L12 (Part A))

LINE NO.						
1	This Months TOTALS	147940	2732	31815		
2	Last Mths Accumulated Totals (from last mths Line No. 3)	–	–	–		
3	This Mths Accumulated Totals (Line No. 1 + Line No. 2)	A 147940	B 2732	C 31815	D	E
4	Sw & Pl — Total Converted Volume (A÷B)×C= (Take A÷B to 3 decimal places)			156600	(Round Off Converted Volumes to Nearest 100 Fbm. or 10 Cuft.)	
5	— Total Converted Volume (A÷B)×D=					
6	— Total Converted Volume (A÷B)×E=					
7	Last Months Converted Volumes = (from line Nos. 4, 5 or 6 of last months sheet)			–		
8	This Months Volume = (Line Nos. 4, 5 or 6 minus Line No. 7)			156600		
9	Indicate Unit of Measure Used Under Column by Marking Square			Fbm. [x] Cuft. [ ]	Fbm. [ ] Cuft. [ ]	Fbm. [ ] Cuft. [ ]

THIS SECTION FOR THE USE OF ALBERTA FOREST SERVICE

For Sample Scale/Sample Weight Ratios — Divide Accumulated Sample Net weight by Accumulated Sample Scales (three decimal places)

Ratio (Line 3) = D÷C = 9.449

Total No. of Loads Weighed This Month

Inspected by Forest Officer

Revised April, 1967

Average Conversion Ratio	=	$\frac{797,200}{103,961} = 7.668$ lbs/FBM or .130407 FBM/lb
Estimated Scale	=	$\frac{\text{Weight}}{\text{Conversion}} = \frac{68,900}{7,668} = 8.985$ FBM
Standard Deviation	=	$\sqrt{\frac{17,225,182}{10-1}} = \sqrt{1,913,909} = +1,383$ FBM
Average Volume/Load	=	$\frac{103,961}{10} = 10,396$ FBM
Coefficient of Variation	=	$\frac{SD}{M} = \frac{1,383}{10,396} \times 100 = 13.3\%$
Sampling Error	=	$\frac{SD}{\sqrt{n}} = \frac{1,383}{\sqrt{10}} = \frac{1,383}{3.16} = \pm 438$ FBM or SE [%] $= \frac{C}{\sqrt{n}} = \frac{13.3}{\sqrt{10}} = \pm 4.2\%$
Population	=	$\frac{5,500,000}{10,396} = 529$ loads
		Average Load Size = 10,396 Sale Size = 5,500,000
Samples Required	=	$n = \frac{Nt^2C^2}{NA^2 + t^2C^2} = \frac{529[2]^2[13.3]^2}{529[5]^2 + [2]^2[13.3]^2} = 26.9$ Samples
Sample Percentage	=	$\frac{26.9}{529} \times 100 = 5.1\%$
Sample Percentage	=	[Using Minimum of 30 Samples] $\frac{30}{529} \times 100 = 5.7\%$

Revised April, 1967

11.2

THEORY OF WEIGHT SCALING

When considering the weight – volume relationship it is readily recognized that many variations in weight occur. Factors influencing variations generally fall into three categories; wood density, moisture content, and unaccountable material, [decay, bark, limbs, small tops].

Although the above items may vary greatly between individual trees or even within any particular tree the basis for sampling lies in the fact that the variations are generally not the extreme but rather tend to compensate and average. This is particularly so when considering populations of several thousand trees or several hundred loads of logs.

The use of weight as a ratio eliminates the variation caused by difference in truck size or load size thus reducing the sampling size to some extent

11.2.1

MEASUREMENT OF VARIATION

Measurement of variation aids in assessing the accuracy of the estimate being made as well as to assess what intensity of sampling may be required to give certain standards of accuracy.

Variation of a population is determined by measuring the individual values around the average value, [mean], for that population. As the variation of a population is rarely known, the variance must be estimated from the sample data.

For Weight scaling the variance of the estimate may be calculated by comparing an estimated scale to the true scale in the sample.

In analyzing the data of a weight sample as in Exhibit 8 the following steps may be considered in calculating the variation of the sample.

EXHIBIT 8
ANALYSIS OF A WEIGHT SAMPLE

Load	Weight	Scale	Estimated Scale	Deviation From True Scale	Deviation^2,
7	68,900	11,649	8,895	– 2,664	7,096,896
19	85,650	10,523	11,169	+ 646	417,316
23	75,050	9,026	9,787	+ 761	579,121
40	88,300	10,690	11,515	+ 825	680,625
49	67,950	10,920	8,861	– 2,059	4,239,481
59	88,850	10,447	11,587	+ 1,140	1,299,600
69	75,600	8,614	9,859	+ 1,245	1,550,025
78	79,750	9,475	10,400	+ 925	855,625
87	76,850	10,139	10,022	– 117	13,689
97	90,300	12,478	11,776	– 702	492,804
	797,200	103,961	103,961		17,225,182

[1] Establish conversion ratio for total loads in data. [It may be noted at this point that 10 samples are used for illustration purposes; however, at least 30 samples are necessary before reliable information can be obtained].

i.e. Exhibit 8

$$\text{Conversion Ratio} = \frac{\text{Total Weight}}{\text{Total Scale}} = \frac{797,200}{103,961} = 7,668 \text{ lbs/M FBM}$$

[2] Calculate an estimated scale for each sample load.

i.e. Exhibit 8, Load No. 7

$$\text{Estimated Scale} = \frac{\text{Weight}}{\text{Ratio}} = \frac{68,900}{7.668} = 8,985 \text{ FBM}$$

[3] The deviation from the true scale is obtained by taking the difference between the estimated scale and the true scale.

i.e. Exhibit 8, Load No. 19

$$\text{Deviation} = \text{True Scale} - \text{Estimated Scale}$$
$$- 10,523 - 11,169 = +646 \text{ FBM}$$

[4] Each deviation is signed by a [+] or [−]. In order to eliminate these signs the deviations are squared.
i.e. Exhibit 8, Load No. 19
Deviation = +646
Deviation^2 = 417,316

[5] The square of the deviations are summed and averaged. However, in order to provide a better estimate of the population variance the sum is divided by the number of samples less one. This may be described by formula as follows:

$$S^2 = \frac{\leq d^2}{n-1}$$

S^2 = Variance
d^2 = Deviation^2
n = No. of Samples
$\leq$ = Summation Sign
i.e. Exhibit 5

$$S^2 = \frac{17,225,182}{10-1} = 1,913,909$$

[6] To compensate for the fact that we averaged the squared deviations we can take the square root of the average and use it as a measure variation. This may be referred to as the Standa Deviation or Standard Error of Estimate and can expressed by Formula as follows:

$$SD = \sqrt{s^2} \text{ or } \sqrt{\frac{d^2}{n-1}}$$

SD = Standard Deviation
S^2 = Variance
i.e. Exhibit 5

$$SD = \sqrt{1,913,909} = \pm 1,383 \text{ FBM}$$

Calculation of standard deviation is sometim done on ratios by comparing the mean conversi factor with conversion factor for individual loa Although this method gives as indication of variati it may be subject to bias in some instances [sampli techniques, Cochran].

[7] In order to relate the standard deviati to the size of the estimate it is necessa to calculate the expression as a decimal percentage. This relationship is referred to as t coefficient of variation and can be found by t following formula: [A short cut method of calc lating coefficient of variation is shown in Append 1]

$$C = \frac{SD \times 100}{M}$$

C = Coefficent of Variation
SD = Standard Deviation
M = Mean [Average Volume/Load]
i.e. Exhibit 8

$$C = \frac{1,383 \times 100}{10,396} = 13.3\%$$

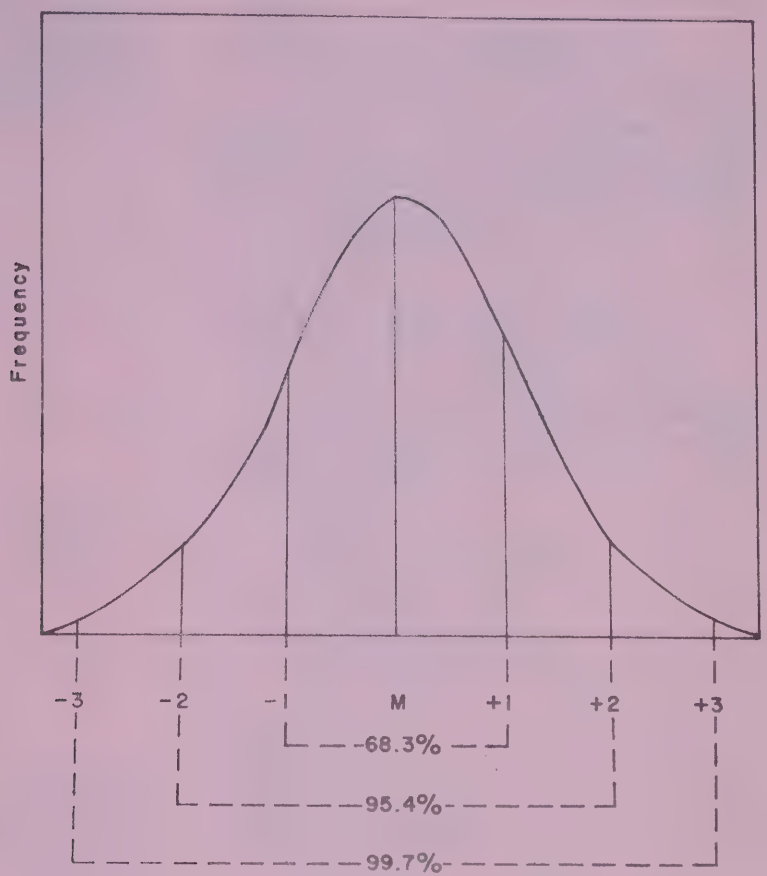
Revised April, 1967

PROBABILITY

It has been found in the past that although individuals of the population vary from one another, when all are considered they form a distinctive pattern of spread. This pattern of spread can be represented by a symmetrical bell shaped curve which is referred to as the normal curve.

The area under the curve represents all the individuals in a population. Statisticians have found it advantageous, however to divide the horizontal axis of the normal frequency curve into 6 units of uniform size and value to provide a basis for analyzing a frequency distribution, [Figure 1]. These units, three plus and three minus are referred to as the standard deviation.

FIGURE 1



Normal frequency curve showing frequency percentage in relation to standard deviations.

When reference is made of ±1 standard deviation we can assume that 68.3 percent of the population is represented. A reference of ±2 standard deviations represent 95.4 percent of the population and a reference of ±3 standard deviations represent 99.7 percent of the population.

In Exhibit 8 it was found that 1 standard deviation was ±1,383 FBM. This means that 68.3 percent of the loads will have a volume within ±1,383 FBM from the mean, [average volume per load]. As the average volume per load when considering weight is in proportion to the weight of the individual load, the estimated scale is equivalent to the average volume per load. This means that 68.3 percent of the true scales will be within ±1,383 FBM from the estimated scales. If so desired, we can assume the reverse with the estimated scale being ±1,383 FBM from the true scale 68.3 percent of the time.

If two standard deviations are considered then we may expect the estimated scale to be within ±2,766 FBM, [2 x 1,383], from the true scale 95.4 percent of the time.

Probability may be defined as the ratio of the number of times an event happens to the total number of trials carried out. It has been found that the pattern of the normal frequency curve is related to the law of probability. It then can be concluded that if 68.3% of the estimates fall within a range of ±1 standard deviation from the true value; then the probability of 68.3 out of 100 that an estimate will be within ±1% of the true volume.

In order to provide a fair certainty that the estimate will fall within the limits of the acceptable sampling area the use of 95.4 percent probability or standard deviation of ±2 will be considered for weight sampling.

ACCEPTABLE SAMPLING ERROR

If several groups of data were chosen from a population and estimates obtained using each group, it would be found that a variance would exist between estimates. This may be referred to as the sampling error. It may then be said that sampling error establishes the mathematical range the true but unknown estimate will fall from the calculated estimate for each probability, [68.3 times out of 100].

It is unnecessary, however, to repeat sampling as a reliable indication of variance and standard error of estimate may be obtained from a single set of data. The sampling error may then be calculated by the following formula:

$$SE = \frac{SD}{\sqrt{n}}$$

SE in percentage

$$SE\ [\%] = \frac{C}{\sqrt{n}}$$

SE = Sampling Error
SD = Standard Deviation
n = Number of Samples
C = Coefficient of Variation

i.e. Exhibit 8

$$SE = \frac{SD}{\sqrt{n}} = \frac{1,383}{\sqrt{10}} = \frac{1,383}{3.16} = \pm 438 \text{ FBM}$$

or

$$SE = \frac{C}{\sqrt{n}} = \frac{13.3}{\sqrt{10}} = 4.2\%$$

In weight scaling sampling is done without replacement or in other words the sample may only be measured and counted once. Because of this sampling method a better estimate of sample error may be obtained by applying a finite population correction factor to the error formula as shown below:

$$SE = \frac{SD}{\sqrt{n}}\left(1 - \frac{n}{N}\right)$$

When sampling becomes less than 5%, effect of factor becomes uneffective and can be ignored. On initial sampling of 1 to 10 the factor may be considered in calculating sample error as follows:

$$SE = \frac{1,383}{\sqrt{10}}\left(1 - \frac{1}{10}\right) = \pm 438\ [.9] = \pm 394$$

It can readily be seen that the accuracy of the estimate can be directly controlled by the number of samples taken or that if an acceptable limit of error is established than this would influence the number of samples required. If too few samples are taken then a large sampling error may result. If too many samples are taken then unnecessary scaling costs are the result.

For weight scaling the acceptable sampling error has been set at ±5% on the basis that the sampling will be taken as accurately as possible.

[It may be noted that check scale allowance remains at ±2% as this may be considered as error of measurement and is not related to sampling error].

POPULATION AND SAMPLE SIZE

The population of the data has a direct influence on the size of sample required. For the purpose of weight scaling the population may be found by use of the average sized load in the sample and proposed volume to be removed in any one period, [preferably yearly basis].

i.e. Exhibit 8
Proposed cut volume = 5,500 M FBM
Average volume/load Exhibit 8 = 10,396

$$\text{Then populations size} = \frac{5,500,000}{10,396} = 529 \text{ loads}$$

A commonly used formula for determining number of samples that are required for a particular population is as follows:

$$n = \frac{Nt^2\ C^2}{NA^2 + t^2\ C^2}$$

n = Number of samples required
N = Population
t = Probability Standard [2]
A = Acceptable Error [±5%]
C = Coefficient of variation Percent

i.e. Exhibit 8
Population [N] = 529
Probability = 2
Acceptable Error [±5%]
Coefficient of Variation = ±13.3%

$$n = \frac{529\ [2]^2\ [13.3]^2}{529\ [5]^2 + [2]^2\ [13.3]^2} = 26.9 \text{ sample required}$$

Sampling percentage may then be calculated:

It might be noted that where number of samples are less than 30 then sample percentage should be calculated using 30 samples

$$\text{Sample Percent} = \frac{\text{No. Samples Required} \times 100}{\text{Population}}$$

i.e. Exhibit 8

$$\text{Sample Percent} = \frac{30 \times 100}{529} = 5.7\%$$

In view of the above it would, therefore, be feasible to sample the remainder of the population at a rate of 6%.

If timber value and type of timber, [age, condition, and species content], is similar in any one quota area, two or more licences may be combined for the purpose of analyzing variation and establishing sample percentage.

After some time of sampling it may be found that the variation within individual strata may be greater than between strata. If this occurs it is then feasible to group entire population under a particular operation and apply a single conversion factor, [11.1.4.2]. In calculation of sample size in the above situation the following would apply:

[a] Population size

$$= \frac{\text{estimated annual production}}{\text{average volume per load}}$$

[b] Coefficient of variation be calculated considering all the strata involved.

[c] Sampling error be considered as ±5% with a probability of 2 standard deviations.

[d] The minimum sample would be no less than 1 percent of the population in any case.

APPENDIX 1

ALTERNATIVE METHOD OF CALCULATING VARIATION

[SAME DATA AS EXHIBIT NO. 8]

FORMULA: [1]

$$Q^2 = \frac{R^2 \Sigma S^2 + \Sigma W^2 - 2R\Sigma SW}{R^2 [n - 1]}$$

Q = Index of Variation

DATA:

Load No.	Weight	Scale	Weight^2	Scale^2	Weight x Scale
7	68,900	11,649	4,747,210,000	135,699,201	802,616,100
19	85,650	10,523	7,335,922,500	110,733,529	901,294,950
23	75,050	9,026	5,632,502,500	81,468,676	677,401,300
40	88,300	10,690	7,796,890,000	114,276,100	943,927,000
49	67,950	10,920	4,617,202,500	119,246,400	742,014,000
59	88,850	10,447	7,894,322,500	109,139,809	928,215,950
69	75,600	8,614	5,715,360,000	74,200,996	651,218,400
78	79,750	9,475	6,360,062,500	89,775,625	755,631,250
87	76,850	10,139	5,905,922,500	102,799,321	779,182,150
97	90,300	12,478	8,154,090,000	155,700,484	1,126,763,400
	797,200	103,961	64,159,485,000	1,093,040,141	8,308,264,500

[1] Sum of scales	ΣS		103,961	
[2] Sum of weights	ΣW		797,200	
[3] Ratio	R		7.6683	
[4] R^2 [6 decimals]			58.802,825	
[5] 2R [4 decimals]			15.3366	
[6] [Sum of Scales]^2	ΣS^2		1.093,040,141	
[7] $R^2\Sigma S^2$				64,273,848,129
[8] [Sum of weights]^2	ΣW^2			64,159,485,000
[9] $R^2\Sigma S^2 + \Sigma W^2$				128,433,333,129
[10] [Sum of weights x scales]	ΣSW		8,308,264,500	
[11] $2R\Sigma SW$				127,420,529,331
[12] $R^2\Sigma S^2 + \Sigma W^2 - 2R\Sigma SW$				1,012.803,798
[13] $R^2[n - 1]$			529.2254	
[14] Q^2			1,913,748	

FORMULA: [2]

$$C^2 = \frac{Q^2 \times 10{,}000}{S^2}$$

C = Coefficient of Variation

[15] Average Scale	S		10,396	
[16] Average Scale^2	S^2			108,076,816
[17] $Q^2 \times 10{,}000$				19,138,140,000
[18] C^2 =				177.07

FORMULA: [3]

$$n = \frac{NC^2}{6.25\,N + C^2}$$

N = 529

n = No. samples required

[19] NC^2		93670.03
[20] $6.25\,N + C^2$		3483.32
[21] n		26.9 samples

Revised April, 1967

APPENDIX 11

ANALYSIS OF PULPWOOD DATA

Weight [tons]	Net Scale [Cords]	Estimated Scale	Deviation From Tree Scale	Deviation^2
41.16	16.70	17.12	+ .42	.1764
30.12	10.78	12.53	+ 1.75	3.0625
34.46	14.01	14.33	+ .32	.1024
31.66	13.29	13.17	− .12	.0144
40.86	17.14	16.99	− .15	.0225
40.72	17.79	16.94	− .85	.7225
36.44	15.40	15.16	− .24	0.576
34.36	14.07	14.29	+ .22	.0484
45.44	19.77	18.90	− .87	.7569
36.14	15.51	15.03	− .48	.2304
371.36	154.46	154.46		5.1940

Ratio = $\frac{154.45}{371.36}$ = .415930 cds/ton

or = $\frac{371.36}{154.46}$ = 2.404 tons/cd

Standard Deviation = $\sqrt{\frac{5.1940}{10 - 1}} = \sqrt{.5771}$ = .76 cords

Average Vol/Load = $\frac{254.46}{10}$ = 15.45 cords

Coefficient of Variation = $\frac{SD}{M} \frac{.76 \times 100}{15.45}$ = 4.9%

Sampling Error = $\frac{SD}{\sqrt{N}} = \frac{.76}{\sqrt{10}} = \frac{.76}{3.16}$ = .24

or SE% = $\frac{C}{\sqrt{n}} = \frac{4.9}{\sqrt{10}}$ = 1.55%

Population = assume 529 loads

Samples Required = $n = \frac{Nt^2 C^2}{NA^2 + t^2 C^2} = \frac{529 [2]^2 [4.9]^2}{529 [5]^2 + [2]^2 [4.9]^2}$ = 3.8 samples

Note: Minimum sampling not to be less than 30 samples or 1 percent of population.

Sample % = $\frac{30}{529} \times 100$ = 5.7 [6%] sampling

Revised April, 1967

APPLICATION OF MOVING AVERAGE [RATIOS]

If after two years of sampling, the variance between areas of an operation are found to be insignificant, a common ratio may be calculated from a prescribed percentage of loads scaled each year and applied on a two year moving average.

Calculation of the moving average should be as follows:

1st Year	
Total weight of all areas	165,474,121 pounds
Total scale estimate of all areas	19,083,625 F.B.M.
Average weighted ratio	8.671 pounds/F.B.M.
2nd Year	
Total weight of all areas	186,723,341 pounds
Total scale estimate of all areas	21,828,775 F.B.M.
Average weighted ratio	8.554 pounds/F.B.M.
Ratio calculation of 3rd Year	
Total of 2 years weights	352,197,462 pounds
Total of 2 year scale estimates	40,912,400 F.B.M.
Ratio for 3rd year	8.609 pounds/F.B.M.

COMPARISON OF VARIANCE

The following is an example of how varian may be compared in regard to sampling:

[a] Variance for each area is calculated as in 11.

[b] Variance for each licence is weighted in prop tion to total number of loads by the follow formula:

Weighted Variance =

$$\frac{[\text{Total loads of A}]^2 \times \text{Variance of}}{[\text{Total loads all areas}]^2}$$

[c] Variance for stratified sampling [weight variance] is totaled.

[d] Variance is calculated as if simple rando sampling has occurred using the total samp loads, [231], by same method as outlined 11.2.1.

[e] The sampling method with the lesser varian will be the most accurate.

EXHIBIT NO. 1

Licence	N [Total Loads]	n [Samples]	Variance	Weighted Variance
A	980	65	14,305.439	1,931.549
B	679	69	3,030.348	196.421
C	642	66	2,604.504	150.921
D	366	31	17,365.876	327.052
Stratified Sampling	2,667	231		2,605.943
Simple Random	2,667	231		1,917.672

In this case simple random sampling combining all licences is best.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

FOREST MANAGEMENT

WOODS OPERATIONS INSPECTION REPORT
FORM NO. 192 (NOW FM 59)

CHAPTER 12

Revised - August 1962

Revised 1967 ?

Revised April, 1967

FOREST MANAGEMENT

CHAPTER 12

WOODS OPERATIONS	Section
General - Purpose	12.1
Form 86 Entry	12.2
Lessee - Licencee - Permittee	12.3
Conditions of Sale, Clauses, etc.	12.4
Remarks - Logging and Milling	12.5
Felling	12.6
Skidding	12.7
Milling	12.8
Mill	12.9
Disposal of Debris	12.10
Roads	12.11
General	12.12
Records	12.13
Summary	12.14

Revised April, 1967

CHAPTER 12

WOODS OPERATIONS INSPECTION REPORT FORM NO. 192 NOW FM 59

12.1 General - Purpose

The purpose of this form is to provide a complete picture of the operation from date of sale until operations have been completed and the berth or special permit is cancelled. By using this form we can provide Divisional and Head Offices with the information required with a minimum of effort.

The report will be made out in quadruplicate. The white and green copies are to be forwarded to the forest superintendent. The pink copy to be forwarded to the licencee and the yellow copy to be held by the district ranger. Corrective action is the responsibility of the division unless the forest superintendent requests the assistance of head office.

12.2 Re: Licence Timber Berth No. 12345
Form FM 74(86) Entry R.D. # & Ranger initial

Divisional Office to initial and Headquarters to initial when entered on Form FM 74 (86).

12.3 Lessee - Licencee - Permittee

The holder of the timber rights - The Contractor - The person or company doing the logging and milling for the holder of the timber.

Camp Number - On some larger berth and lease areas there will be more than one camp and separate reports are required for each camp.

12.4 Conditions of Sale, Clauses, etc.

Some of the most commonly used clauses and conditions of sale that appear in berths are listed on the form so that the Forest Officer making the inspection would have the information readily available. Conditions of sale that apply to the specific berth or permit, etc., should be listed on the inspection form (page one) before going into the field. Particular attention should be paid to water courses. Stream crossings should be kept to minimum. Logging or mill debris must be kept out of streams. Make sure that reserve strip is being maintained.

For example:

	Required	Satisfactory
Stump diameter	12" Pine	x
Tree marking	Yes Spruce	No
Scarification	N. A.	N. A.
Annual Operating Plan	N. A.	N. A.
Brush Disposal	Lop & scatter	x

During inspection unmarked trees were found being cut. Note on back of page under the heading "Forest Officer's Remarks on Unsatisfactory Items" would read "unmarked trees being cut in Legal Subdivision 12 of Section 1, 303 trees tallied and scaled at 60,300 f.b.m. Recommend double dues be charged re. scaled volume".

12.5 Remarks - Logging and Milling

Most of the items under skidding, felling, milling, mill, etc., may be answered by a check mark, others may require "yes" or "no". It is important, however, to list by number on the back of page (Forest Officer's Remarks on Unsatisfactory Items) the reason items are unsatisfactory and action taken. If unsatisfactory items are found, make sure that these are brought to the licencee's attention and that the licencee signs at the bottom of page two.

Partial explanation follows as to the reason for some new items on the revised report Form No. 192; now FM 59.

12.6 Felling

1. Cutting Progressive - The operator may have two or more sides going at opposite ends of the berth and still have progressive cutting. Progressive cutting within these units requires that areas of small volume timber be taken along with the heavier volume. In other words, is high grading taking place?

3. Herring-bone felling pattern? Trees should be felled at an angle into the skid trail so that they may be skidded with the least damage to the reserve stand. Even on clear cut areas trees should be felled in one direction to prevent breakage on felling and skidding.

4. Skid trails should be blazed and/or built so that fallers know which direction trees are to be taken out.

7. Tops to "____" inches? This was left blank on the form because of variations between top utilization of sawlogs, pulp and peeler logs, etc., and should be filled in by the inspecting officer.

8. Log Lengths should be varied so that sweep, crook, school marms, and other defects may be bucked to minimize waste.

9. The optimum trim for saw logs is 4 inches, however, trim may vary from a minimum of 2 inches to a maximum of 6 inches.

Trim for peeler logs varies from a minimum of 6 inches to a maximum of eight inches.

12.7 Skidding

12. Horses used

13. Crawler tractors used

14. Other - jammer, rubber tired rigs, etc.

12. If horses only are used the other two spaces may be left blank.

13. Tractor blade removed while skidding? The blade may be left on the cat and the answer may be satisfactory if the area is to be clear cut and scarified.

(b) & (c) Winch and mainline refer to skidding logs or trees from areas where reproduction and/or reserve stands are present. Again, if the area is to be clear cut and scarified there would be no objection to the cat going off the skid trail to pick up the turn.

15. Reserve trees being damaged? A few trees will be damaged during logging. Do you consider that damage is unnecessary and could be avoided?

12.8 Milling

18. Slabs

In most cases slabs are burned at the mill and a true picture of the slabs is not always possible. However, by checking the lumber, the number of short or medium length 1 x 4's is a very good indication as to whether slabbing is heavy or light. If there are very few 1 x 4's you can be assured slabbing is too heavy.

In most cases where you have found poor milling or logging and have given a low rating indicating that corrective action is necessary, you will not stop at this point. A memo is to be attached to the report advising what corrective action you have taken along with your recommendations. If subsequent reports show no improvement Head Office will then take action upon the request of the Forest Superintendent. It is your district and the quality of the operation is in your hands. For example, many reports come in showing "No Records Available". This does not excuse you from finding out why and taking corrective action through Divisional and Head Office, if the situation can be dealt with on

the spot. You, the Forest Officer, are responsible for the operation and must be prepared to accept the responsibility.

19. Edgings

This requires some observation at the edger but again a visual check of the lumber to see what per cent has waney edges is a very good guide to judge whether edgings are too heavy or too light. If there are no waney edges, edging must be heavy.

20. Trim Wasteful

Long logs may make trimmings appear heavy when really they are not. Wasteful trimming would be in case of a 2 x 8 with waney edge of four feet on one side and trimmed four feet. Actually this 2 x 8 should have been resawn into 2 x 4's and the four feet of waney trimmed off a 2 x 4 and not a 2 x 8. Make some notes as to actual board feet being wasted in this manner and bring it to the attention of the operator, always bringing up profit angle. On wide stock the waste is increased especially on two inch stock.

21. Lumber Wedge Shaped

Lumber is usually measured where the log first touches the saw. It is well to measure both ends of the stock as one end may be true and the other not, due to careless dogging or mechanical faults.

22 & 23 STANDARD THICKNESS & WIDTH (DIMENSION)

Nominal Width	Dressed Width	Approx. Shrinkage	Surfacing Loss	Variation in Sawing	Rough Green Dimension
2	1 5/8	1/8	1/8	1/8	2
4	3 5/8	2/8	1/8	1/8	4 1/8
6	5 1/2	3/8	1/8	1/8	6 1/8
8	7 1/2	4/8	1/8	1/8	8 1/4
10	9 1/2	5/8	1/8	1/8	10 3/8
12	11 1/2	6/8	1/8	1/8	12 1/2

STANDARD WIDTHS (BOARDS)

Nominal Width	Dressed Width	Approx. Shrinkage	Surfacing Loss	Variation in Sawing	Rough Green
2	1 5/8	1/8	1/8	1/8	2
4	3 5/8	2/8	1/8	1/8	4 1/8
6	5 5/8	3/8	1/8	1/8	6 1/4
8	7 5/8	4/8	1/8	1/8	8 3/8
10	9 5/8	5/8	1/8	1/8	10 1/2
12	11 5/8	6/8	1/8	1/8	12 5/8

STANDARD THICKNESS (BOARDS)

Nominal Thickness	Dressed Thickness	Approx. Shrinkage	Surface Loss	Variation in Sawing	Rough Green
1"	25/32	2/32	4/32	4/32	35/32

The above figures are based on a shrinkage factor of 1/16 of an inch per inch of width. In dimension width may be interchanged for thickness.

If dimension stock is to go for resaw an additional allowance should be made depending on resaw kerf plus additional allowance for surfacing. The above figures should be the maximum allowed for green sawn dimension and boards where no resawing is to be done.

Items 18 - 23 indicate mill and sawyer efficiency. If the mill is producing good lumber the sawyer and the mill must both be efficient.

Mill power was left out of the new form No. 192 because of the related factors, such as rate of feed, ratio of power unit R.P.M. to saw R.P.M., poorly pounded or poorly filed saws, etc.

12.9 Mill

25. Headrig type and kerf - circular, band, whole log gang, or scrag.

The above information should indicate the probable overrun to be expected over tree scale or log scale.

26. Cant gang will also indicate if overrun is to be expected over tree scale or log scale.

29. Camp Sanitation - Particular note should be made of garbage pits. Pits should be dug with dozer. An open or exposed garbage dump encourages bears. Pits should be covered by dirt each spring. 12.10.

12.10 Disposal of Debris

30. Has debris from mill clearing been burned? Has debris been windrowed so that burning could take place when weather conditions are favourable?

Burned - Satisfactory

Windrowed but not burned - unsatisfactory but no action recommended till weather conditions are favourable for burn.

Debris pushed into standing timber - unsatisfactory and immediate cleanup required.

32. Distance between sawdust pile and slab pit --- feet.

Section 13 (2) (d) O.C. 550/62 of the Regulations authorized by The Forests Act states:

The distance from the sawdust pile to the mill, factory or operation and from the sawdust pile to the burner or pit shall be not less than 75 feet. (See Figure 1, Diagram) -

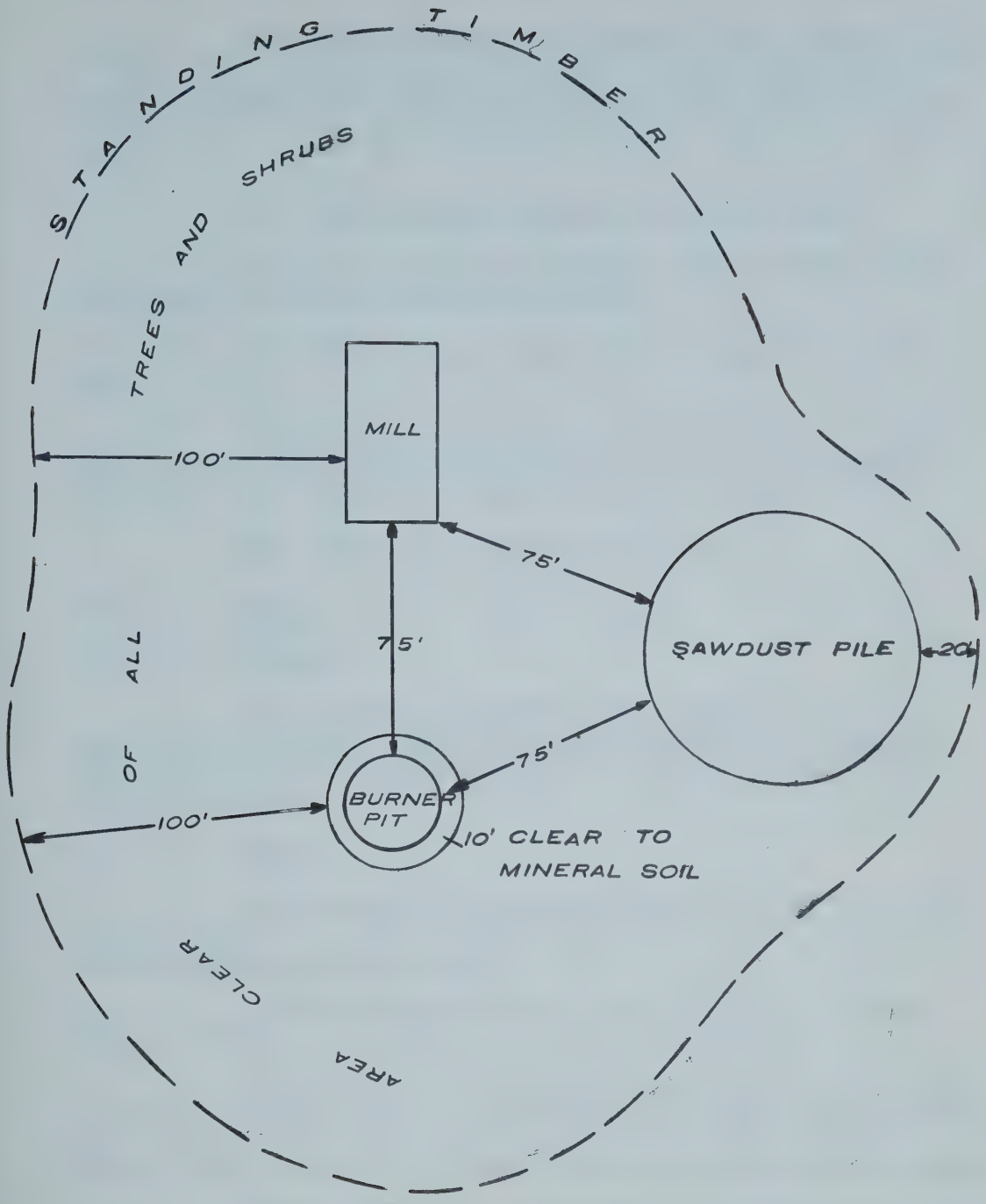


Figure 1

Diagram showing minimum distances from burner to sawdust pile, sawdust pile to mill and mill to burner.

Please note these distances are minimums.

Debris from clearing shall be windrowed away from standing timber and shall be burned when conditions are favorable.

Refer to Page 4 Section 13 Alberta Regulations 225/62
(O.C. 550/62)

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33. Some mill operators allow sawdust to pile up against the mill buildings. Since mills have a high fire frequency and there is danger that a mill fire will continue on into the sawdust pile, the forest officer must see that there is adequate space between mill building and sawdust pile. (See Sec. 13 (2) (d) above.)

35. Distance between burning pit and standing timber.

Section 13, (2) (a) of the Regulations requires that there be 100 feet between the burning pit and the standing timber.

36. Estimate volume F.B.M. that will be cut at present mill site?

Item 36 refers to future volume - if the operator has cut 5 million f.b.m., and the clearing is becoming inadequate. He still has an estimated 5 million left to saw. Arrangement should be made now to enlarge the clearing.

38. Slash may be lopped or burned.

12.11 Roads

12.12 General

41. Any danger of trespass? Has the operator been with you along the berth boundaries? Are the lines clearly blazed? Has the operator informed his cutters as to the location of lines or natural boundaries? Should the lines be renewed?

12.13 Records

It is important that records be listed from the first of the month to the end of the month. In cases where the inspection covers a two month period, records must be broken down by months.

In some cases Head Office may request through the Divisional Offices a breakdown of gross volume to purchasers from small mills.

The use of this form helps to encourage the operator to keep records up to date. It should be pointed out to the operator that an efficient bookkeeping system often means the difference between profit and loss. Records should be complete to the point that production and sales record on this form can be completed.

The time has come when the field man must pay more attention to records. All books and forms for an operation are supplied free of charge and the operator has no excuse for incomplete records.

It is not expected that you are to become the operator's bookkeeper but you may set up his books at the start of an operation and point out to him that they must be kept in order and up to date.

The rating given for records, especially where they are found to be incomplete, etc., should be considered carefully and in the remarks, cover the matter thoroughly, with a view to obtaining improvement.

In cases where an operator fails to keep the required records, and they are found to be unkept, or non-existent or unavailable for inspection, subsequent to your request for them and his co-operation is not forthcoming, after being duly warned in writing, it is suggested that action be considered to request suspension of the operation under the provisions of the Act. Therefore, such action must be given consideration, and enforced before the operator's bush operations are completed for the season, or for the permit or berth area, to obtain the desired result.

12.14 Summary

In dealing with The Forests Act or Regulations point out why these exist and the purpose behind them. Just to say this is The Forests Act and must be obeyed leaves a bad impression. You may persuade and encourage, but it is difficult to force people to do things.

Make the operator feel that you are interested in his welfare and that you respect his opinions of how woods operations should be conducted. It is a case of team work between the operator and the field staff.

12.15 Please refer to Divisional Circular T.6, Ranger's Circular T.6.

Alberta
LANDS AND FORESTS
Forest Service

Timber Management Branch

TIMBER MANAGEMENT

CONIFEROUS TIMBER APPRAISALS IN ALBERTA

for

SAWLOG OPERATIONS

CHAPTER 13

Effective May 1st, 1974
Until April 30th, 1976

Revised April, 1967

TIMBER MANAGEMENT

CHAPTER 13

CONIFEROUS TIMBER APPRAISALS IN ALBERTA

FOR

SAWLOG OPERATIONS

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13.1

BASIC TERMINOLOGY & EXPLANATION

This appraisal system is intended for use in stands suitable for the production of sawlogs, peeler logs, ties or related products. Costs are not related to roundwood (e.g. post) production. Small diameter pine stands suitable for the production of roundwood are issued by the Department at the regulation dues rate unless these stands are defective or of below average form in which case a lesser rate may be established. Only where roundwood products are produced from the same licence in association with sawlog or peeler log production would they be included in appraised calculations.

This timber appraisal system is based on the assumption that as the net return to the operator becomes less due to high harvesting costs, the dues should fall whereas higher dues should be charged wherever a harvesting chance is such that larger than average returns are probable.

Although there is a long list of variables each of which may affect costs, four have been selected as the most important factors which are consistently measurable for a particular stand of timber. They are:

(1) Average haul distance to the nearest usable trackage point located at a community of at least village status by the shortest logical haul route.

(2) Average GROSS volume per harvestable acre.

(3) Average GROSS volume per tree (measured in terms of average diameter and then converted to volume, or measured directly in terms of volume).

(4) Average cull in percent of gross volume.

Topographical features are not directly considered except as major features which would alter logical hauling routes to railhead. The effect of topography on skidding costs is difficult to measure as slopes may actually reduce skidding costs when roads and mill location are properly planned. Similarly, muskeg and bog conditions do not seriously increase access costs provided operations are planned so that such areas are traversed in the winter months. The profitability of any individual licence is therefore measured by the four factors listed above.

13.1.1

THE DOLLAR FACTOR

The dollar factor is the end result of each timber appraisal. This factor expresses the amount by which the crown dues for a particular licence or permit will vary from the regulation rate of crown dues for any given period of time.

In the past it was necessary to calculate the conversion return for each licence based on the relationship of production costs to the average mill net selling price for the previous year. This ratio has not remained stable due to the extreme variability in the lumber market and as such is not the best index. Based upon all the information pertaining to past conversion return ratios, a fixed ratio of 1.5 to 1 was adopted in 1972.

The adoption of the fixed ratio in essence means that 1/1.5 or 66.67% of the total cost variance from that of average conditions will be recognized in the final dollar factor. This principle of course, applies to all appraisals regardless of whether they are negative or positive.

13.2

THE COST SURVEY

The results of the cost survey are presented in Table I

A number of operators who employed the methods of hauling tree length or long log loads to a centralized mill on trackage reported their costs in detail forming the basis of the table.

Before using the production cost summary it is important to realize the following points:

(1) Costs were collected from a number of operators throughout the province, in order that the final production cost summary would present a cross section of operating conditions, including timber volumes, topography, climate and operating season.

(2) All costs are based on the production of dimension lumber only and do not include costs of producing other forest products such as one inch boards, ties or chips.

(3) In general, this cost picture covers the 6 month period prior to May 1, 1974. In addition a few of the individual cost items such as road and hauling costs along with some of the fixed costs are based on cost data from the first half of 1974.

(4) All costs have been adjusted to the provincial average conditions of the four appraisal factors.

(5) The costs of logging and log hauling to the sawmill are based on actual lumber outrun and not on log scale. Where operating costs were reported on the basis of weight scale production they were adjusted to take into account the overrun factor. Therefore actual logging costs are shown in Table I.

(6) The basis of the cost variable tables for hauling, average gross volume per acre and average gross volume per tree along with the calculation of the cull cost variable is taken directly from the production cost summary in Table I.

13.2.1

TABLE I

Provincial Cost Averages per M f.b.m. of Production
Based on the Operation of Average[3] Timber
Established April 1, 1974

A.	Logging and Hauling			
	1.	Fall, Limb and Top	$ 4.40	
	2.	Skid to Landing	8.97	
	3.	Construction of Bush Roads & Landings	2.98	
	4.	Bush Planning and Supervision	2.57	
	5.	Camp Loss	2.46	
	6.	Allowance for Profit	1.26	
	7.	Loading	2.84	
	8.	Main Road Establishment and Maintenance (Basis – average distance of 24 miles @ 11.5c per M mile)	2.48	
	9.	Hauling (Basis – Average haul distance 62.5 miles @ 25c per M mile)	14.07	
		Sub Total to Sawmill		$ 42.03
B.	Weighting, Slashing and Sawing			
	10.	Weighting, Bucking and Scaling	0.71	
	11.	Unloading, Decking and Mill Feed	3.71	
		Note: Items 1 to 7 inclusive and 9 – 11 inclusive are based on actual lumber outturn and not log scale.		
	12.	Mill Operation and Maintenance	16.25	
	13.	Sawmill Supervision	1.48	
	14.	Sawmill Depreciation and Interest on Investment	2.09	
	15.	Sawmill Insurance and Taxes	0.93	
		Sub Total Mill Yard and Sawmill		$ 25.17
C.	Drying			
	16.	Dry Kiln	3.76	
		Sub Total Dry Kiln		3.76
D.	Planing			
	17.	Planer Mill Feed and Mobile	1.50	
	18.	Planing and Loading (includes supervision)	8.95	
	19.	Planer Mill Depreciation and Interest on Investment	1.05	
	20.	Planer Mill and Inventory Insurance and Taxes	0.84	
		Sub Total Planing Costs		$ 12.34
E.	Administrative Costs			
	21.	Management and Office	3.30	
	22.	Alberta Forest Service Charges (Holding and Protection and Cruising)	0.60	
		Sub Total Administrative Costs		$ 3.90
		TOTAL PRODUCTION COSTS		**$ 87.20**

Note 1: All costs shown above include depreciation and interest on investment.

Note 2: The above charges do not include stumpage and reforestation costs.

Note 3: Average Timber Chance:

Average Haul Distance	62.5 miles
Average Private Road Construction	24 miles
Average Gross Volume per Acre	12,200 FBM
Average Gross Volume per Tree	132 FBM
Average Interior Cull Percent	9.0%

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13.3

THE CALCULATION OF THE INDIVIDUAL COST FACTORS

POPLAR AND BALSAM FIR ARE NOT CONSIDERED in timber appraisals. Species included are Spruce, Pine and Douglas Fir.

The calculation of the individual cost factors has been completed for a range of conditions and these calculations are presented in tabular form, with a separate table for road and haul costs, volume per acre and volume per tree. The calculation of the cull cost factor is accomplished by use of a formula.

If an individual desired value lies between two stated values in a table, straight line interpolation should be used to obtain the desired value in all cases.

13.3.1

CALCULATION OF THE ROAD AND HAUL COST FACTOR

Haul costs are broken into a straight trucking cost allowance shown under Caption "A" and Road Cost Allowances shown under Captions "B" and "C".

"Caption A"

The trucking cost allowance is based on the total haul distance following the shortest logical route from the centre of the timber disposition being appraised to the nearest usable railway trackage at a community of at least village status, regardless of present planer location. Present planer location is ignored for several reasons:

(a) timber value should not be reduced due to inefficient plant location. To do other than appraise to the nearest usable trackage located at a village could result in dues increases for licensees or permittees who move their plant to a closer more efficient location.

(b) at all times it should be remembered that the government is appraising timber as is, where is. Timber cannot be considered to change in value because it changes in ownership (e.g. is operated by another licensee).

Since the average total haul distance is 62.5 miles for the province distances of less than 62.5 miles decrease costs by the amounts shown while the reverse is true for haul distances exceeding 62.5 miles.

"Caption B"

The road cost factor of 11.5 cents per M per mile reflects the cost of building and maintaining main haul roads from the nearest useable government road or trackage point to the timber by the most direct feasible route. Actual costs are considered to average 13.4 cents per M per mile for a winter haul – summer access type road where 4.8 MM FBM is being removed per year. Ignoring uneconomic (less than 500 M per year) quotas, the average quota in Alberta is 4.8 MM per year. The average construction cost on the average quota is 9.4 cents per M mile which was reduced by 20% to 7.5 cents per M mile in consideration of road rentals received from other industrial users. Adding the average road maintenance costs of 4 cents per M mile to the construction costs yields an average road factor of 11.5 cents per M mile.

Government roads are any roads built and maintained by the Department of Highways, the Department of Lands and Forests or the Department of Municipal Affairs. Where the forest products industry used roads built by another industry (e.g. oil) the full construction and maintenance factor will be allowed.

Since the timber appraisal system has been converted from a base of hauling rough lumber to loading and hauling of tree length or long logs the minimum G.V.W. rating will be 72000 pounds. In other words if a particular haul route for a timber disposition involved in part, a government road and if this same government road was incapable of supporting loads of 72000 pounds G.V.W. the full construction and maintenance factor (Caption "B") must be allowed to the point where a 72000 pound road is available or if no such road is available, to the designated trackage point itself.

"Caption C"

On occasion, the lumber industry may utilize roads which were built but are not maintained by any of the provincial government departments. In other words the column under Caption C should be used where the industry is using or could logically use and maintain a government road capable of supporting loads of 72000 pounds G.V.W. for a portion of their haul to rail.

The above description applies to Table II entitled "Influence of Haul Distance and Road Development on Production Cost" which follows under 13.3.1.1.

13.3.1.1

TABLE II
Influence of Haul Distance and Road Development on Production Cost

Mileage	Rate $ per M fbm	A. Haul Cost Factor $ per M fbm	B. Road Cost Factor $ per M fbm	C. Partial Cost Factor $ per M fbm
150	32.25	+16.63		
145	31.18	+15.56	Construction and	
140	30.10	+14.48	Maintenance	Maintenance Only
135	29.02	+13.40	Basis 11.5c	Basis 4c per M
130	27.95	+12.33	Per M Per Mile	Per Mile
125	26.88	+11.26	+11.62	+5.00
120	25.80	+10.18	+11.04	+4.80
115	24.72	+ 9.10	+10.46	+4.60
110	23.65	+ 8.03	+ 9.89	+4.40
105	22.58	+ 6.96	+ 9.32	+4.20
100	21.70	+ 6.08	+ 8.74	+4.00
95	20.71	+ 5.09	+ 8.16	+3.80
90	19.80	+ 4.18	+ 7.59	+3.60
85	18.96	+ 3.34	+ 7.02	+3.40
80	18.16	+ 2.54	+ 6.44	+3.20
75	17.40	+ 1.78	+ 5.86	+3.00
70	16.66	+ 1.04	+ 5.29	+2.80
65	15.99	+ 0.37	+ 4.72	+2.60
62.5	15.62	0.00	+ 4.43	+2.50
60	15.30	– 0.32	+ 4.14	+2.40
55	14.58	– 1.04	+ 3.56	+2.20
50	13.85	– 1.77	+ 2.99	+2.00
45	13.14	– 2.48	+ 2.42	+1.80
40	12.32	– 3.30	+ 1.84	+1.60
35	11.44	– 4.18	+ 1.26	+1.40
30	10.50	– 5.12	+ 0.69	+1.20
25	9.52	– 6.10	+ 0.12	+1.00
24			0.00	+0.96
20	8.44	– 7.18	– 0.46	+0.80
15	7.23	– 8.39	– 1.04	+0.60
10	5.71	– 9.91	– 1.61	+0.40
5	5.14	–10.48	– 2.18	+0.20
1	4.19	–11.43	– 2.64	+0.04
0	0.00	–15.62	– 2.76	0.00

Establishment of "A" Factor rates under 10 miles based on average loading and unloading times, in consideration of the fact that time is the important aspect in the contract and not distance.

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13.3.1.2

USE OF TABLE II (UNDER 13.3.1.1)

Situation I

Licensee hauling 70 miles to trackage, 20 miles of which is on road built and maintained by an oil company:

Allowance under 'A'	+ 1.04
Allowance under 'B'	– 0.46
Cost Factor Allowance	+ 0.58

Situation II

Licensee hauling 95 miles to trackage, 91 miles of which is on a numbered highway:

Allowance under 'A'	+ 5.09
Allowance under 'B'	– 2.30
Cost Factor Allowance	+ 2.79

Situation III

Licensee hauling (as in Situation I above) 70 miles to trackage, 20 miles of which is on road built and maintained by the licensee, and 10 miles of which is on a road built but not maintained (snow–plowed) by the Alberta Forest Service:

Allowance under 'A'	+ 1.04
Allowance under 'B'	– 0.46
Allowance 'C'	+ 0.40
Cost Factor Allowance	+ 0.98

Situation IV

Licensee hauling 30 miles to trackage, 12 miles of which is on road built and maintained by the licensee (18 miles on government road).

Allowance under 'A'	– 5.12
Allowance under 'B'	– 1.38
Cost Factor Allowance	– 6.50

13.3.2

CALCULATION OF THE GROSS VOLUME PER ACRE FACTOR

The harvestable gross volume of spruce, pine and douglas fir only should be summed for all HARVESTABLE timber types within the licence or permit area; and then divided by total loggable acreage to obtain an average gross volume per acre. Deciduous species and BALSAM FIR ARE TO BE IGNORED IN THESE CALCULATIONS. The resulting figure will be the average gross volume per acre of spruce, pine and douglas fir. The cost factor allowance for gross volume per acre is calculated through the use of straight line interpolation using Table III under 13.3.2.1

13.3.2.1

TABLE III

COST DIFFERENCE IN RELATION TO VOLUME PER ACRE

Gross Volume Per Acre		Cost Factor $ Per M FBM
1,000	.....	+15.20
2,000	.....	+ 9.55
3,000	.....	+ 6.50
4,000	.....	+ 4.90
5,000	.....	+ 3.65
6,000	.....	+ 2.75
7,000	.....	+ 2.05
8,000	.....	+ 1.50
9,000	.....	+ 1.05
10,000	.....	+ 0.65
11,000	.....	+ 0.30
12,000	.....	+ 0.05
	Average Volume/Acre = 12,200	0.00
13,000	.....	– 0.20
14,000	.....	– 0.45
15,000	.....	– 0.70
16,000	.....	– 0.85
17,000	.....	– 1.05
18,000	.....	– 1.20
19,000	.....	– 1.35
20,000	.....	– 1.45
21,000	.....	– 1.60
22,000	.....	– 1.70
23,000	.....	– 1.80
24,000	.....	– 1.90
25,000	.....	– 1.95
26,000	.....	– 2.05
27,000	.....	– 2.10
28,000	.....	– 2.20
29,000	.....	– 2.25
30,000	.....	– 2.30

13.3.3

CALCULATION OF THE TREE SIZE FACTOR

Tree size is one of the most significant appraisal factors because of the large effect of tree size in both logging and milling costs per M f.b.m. of final product.

When cruising to establish tree size, the calculations must be based only on those trees which are designated for cutting in the timber licence or permit concerned. For example, if the timber licence designates that all trees measuring 10.0 inches on the stump are to be cut, then only trees measuring 10.0 inches or more on the stump should be included in the calculation of average tree size. Trees with stump diameters of less than 8 inches are not to be included in the calculation of tree size for appraisals. Where MARKED TREES ONLY are to be removed, then tree size calculations should be based on removal of 40% of the volume distributed evenly in all merchantable size classes. BALSAM FIR SHOULD BE IGNORED IN THESE CALCULATIONS WHICH SHOULD BE BASED ON SPRUCE, PINE AND DOUGLAS FIR ONLY.

Where tree size is calculated from mill production in f.b.m. divided by tree count to obtain volume per tree, it will be necessary to increase the mill production by an amount equal to the amount of cull lumber discarded, because tree size calculations are based on GROSS VOLUME PER TREE with a separate allowance for cull.

Care should be taken when establishing average tree size to see that the gross volume of appraised species is summed for all harvestable stands in a timber disposition. The number of trees making up that volume are also summed for these stands. The average tree size is the total gross volume of Spruce, Pine and Douglas Fir divided by the number of trees making up this volume. When based on mill and bush production records, ensure that all sizes of merchantable timber have been included in the sample.

Once the average gross volume per tree has been calculated, the cost factor may be read or interpolated directly from Table IV under 13.3.3.1.

TABLE IV
INFLUENCE OF TREE SIZE ON PRODUCTION COST

GROSS TREE VOLUME IN F.B.M.	COST FACTOR IN DOLLARS PER M F.B.M.		*APPROXIMATE D.B.H. (inches)	COST FACTOR IN DOLLARS PER M F.B.M.
			8.0	+37.50
			8.2	+33.35
			8.4	+29.25
			8.6	+26.65
25	+43.75		8.8	+23.40
30	+35.50		9.0	+20.90
			9.2	+18.75
40	+25.80		9.4	+16.95
50	+19.20		9.6	+14.75
			9.8	+13.20
60	+14.75		10.0	+11.55
70	+11.20		10.2	+10.40
			10.4	+ 9.00
80	+ 8.50		10.6	+ 7.55
90	+ 6.20		10.8	+ 6.50
			11.0	+ 5.45
100	+ 4.30		11.2	+ 4.30
110	+ 2.80		11.4	+ 3.40
			11.6	+ 2.50
120	+ 1.40		11.8	+ 1.55
130	+ 0.20		12.0	+ 0.80
			12.2	+ 0.20
132	0.00	Provincial Average	12.3	0.00
140	– 0.80		12.4	– 0.45
			12.6	– 1.20
150	– 1.75		12.8	– 1.75
160	– 2.55		13.0	– 2.25
			13.2	– 2.85
170	– 3.30		13.4	– 3.30
180	– 3.90		13.6	– 3.75
			13.8	– 4.20
190	– 4.50		14.0	– 4.50
200	– 5.00		14.2	– 4.75
			14.4	– 5.15
210	– 5.40		14.6	– 5.40
220	– 5.80		14.8	– 5.80
			15.0	– 6.10
230	– 6.15		15.2	– 6.35
240	– 6.45		15.4	– 6.50
			15.6	– 6.75
250	– 6.75		15.8	– 7.05
260	– 7.00		16.0	– 7.25
			16.2	– 7.50
270	– 7.25		16.4	– 7.70
280	– 7.55		16.6	– 7.85
			16.8	– 8.05
290	– 7.75		17.0	– 8.20
300	– 7.95		17.2	– 8.40
			17.4	– 8.50
320	– 8.35		17.6	– 8.60
340	– 8.60		17.8	– 8.70
			18.0	– 8.85
360	– 8.85			
380	– 9.00			
400	– 9.15			
420	– 9.30			

*Whenever possible, tree size should be directly calculated and expressed in terms of gross volume per tree. The cost factors themselves are directly related to volume per tree.

Revised April, 1967

13.3.4

EFFECT OF DECAY PERCENTAGE ON COSTS

The percentage of gross volume which cannot be manufactured into a product saleable at the mill for any price is considered to be the cull percentage. Low grade material is not cull if it can be sold for the price of its transportation from mill to market.

The calculation of the cost factor establishing the effect of cull on operating costs is accomplished through the use of a formula. Basically this formula is intended to express the extra cost of handling the cull material as compared to the situation had there been no cull (zero cull) whatsoever. This cost differential is then compared to the average provincial timber chance which is 9 percent cull.

Because cull is considered to effect most of the bush costs along with log handling and sawing at the manufacturing site the effect of this cull is considered to vary with the three conditions of gross volume per acre, gross volume per tree and haul distance.

In order to establish the effect of cull on operating costs it is first necessary to separate those costs which are fixed from those costs which are considered to vary with the conditions of gross volume per acre, gross volume per tree and haul distance.

The production costs involved in the structuring of the three previous cost tables have already excluded fixed costs. The variable costs are summarized as follows:

	Category	Average Variable Cost	
1.	Hauling	14.07	
2.	Gross volume per acre	6.50	
3.	Gross volume per tree	28.26	
	Total Variable cost base		48.83

Since the total variable cost at average conditions of haul, gross volume per acre and gross per tree is $48.83, the calculation needs only to be done by adding the total plus or minus cost factors to the variable cost ($48.83).

Example			
	Haul Distance = 40 miles	−3.30	
	Gross Volume/Acre = 7000 FBM	+2.05	
	Gross Volume/Tree = 200 FBM	−5.00	
	Total Cost Factor		−6.25
	Adjusted Variable Cost = 48.83 + (−6.25) = 42.58		

The formula derived for the calculation of the effect of cull on all three variables is:

$$\text{Cull Cost Factor} = (\text{Total Base} + \text{Total Cost Factor}) \times \frac{91}{100-R}$$

Where R = Actual Cull Factor for Timber Expressed in Terms of %.

The application of the factor 91 is for the purpose of reducing the base from a level of 9% cull to a level of zero percent.

Therefore:

$$\text{Cull Cost Factor} = \frac{(\text{Total Base} + \text{Total Cost Factor}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

Using the example of Haul Distance at 40 miles, Gross Volume per Acre of 7000 FBM and Gross Volume per tree of 200 FBM as above the effect of cull when the cull percent is 15 is derived through the formula as follows:

$$\text{Cull Cost Factor} = \frac{(48.83 + (-6.25)) \times 91}{100 - 15} - 42.58$$

$$\text{Cull Cost Factor} = 45.59 - 42.58$$

$$\text{Cull Cost Factor} = +\$3.01$$

Whenever the cull percentage is above the average of 9 percent the resulting cost factor will always be plus and whenever the cull percentage is below the average of 9 percent the resulting cost factor will always be minus.

Further examples of calculation of cull percent with given conditions of haul distance and volume follow.

Calculation of cull factors for timber licence situations:

Example 1

(a) Average tree size = 200 FBM
(b) Average haul distance = 10 miles A factor
(c) Average volume per acre = 7000 FBM
(d) Average cull percent = 15%

Total Base	$48.83	
Tree size factor	−5.00	
Haul cost factor	−9.91	
Volume per acre factor	+2.05	
Adjusted variable cost		35.97

$$\text{Cull Cost Factor} = \frac{(\text{Total Base} + \text{Cost Factors}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

$$\text{Cull Cost Factor} = \frac{\$35.97 \times 91}{85} - 35.97$$

Cull Cost Factor = 38.51 − 35.97

Cull Cost Factor = +2.54

Example 2

(a) Average tree size = 90 FBM
(b) Average haul distance = 90 miles A factor
(c) Average volume per acre = 8000 FBM
(d) Average cull percent = 5 percent

Total base	$48.83	
Tree size factor	+6.20	
Haul Cost factor	+4.18	
Volume per acre factor	+1.50	
Adjusted variable cost		60.71

$$\text{Cull Cost Factor} = \frac{(\text{Total base} + \text{Cost Factors}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

$$\text{Cull Cost Factor} = \frac{60.71 \times 91}{95} - 60.71$$

Cull Cost Factor = $58.15 − 60.71

Cull Cost Factor = −$2.56

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13.4.1

EXAMPLE OF TIMBER APPRAISALS

Example 1

(a) Average haul distance to trackage is 60 miles, 35 miles of which is on a government built and maintained highway. The remaining 25 miles on a country road of less than 72,000 lbs. G.V.W. load limit.
(b) Average gross volume per acre (Sw & Pl) = 11,000 f.b.m./acre
(c) Average gross volume per tree (Sw & Pl) = 180 f.b.m./tree
(d) Average cull % = 8%

		CALCULATION OF	
(1) HAUL AND ROAD COSTS		CULL FACTOR	COST FACTOR
A 60 miles		- 0.32	- 0.32
B 25 miles			+0.12
C miles			
(2) Average gross volume per acre 11,000 f.b.m.		+0.30	+0.30
(3) Average gross volume per tree 180 f.b.m.		- 3.90	- 3.90
Average cull 8 %	Total Base	48.83	
Adjusted Variable Cost		44.91	

$$\text{Cull Cost Factor} = \frac{(\text{Total base} + \text{Cost Factor}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

$$\text{Cull Cost Factor} = \frac{(\quad 44.91 \quad) \times 91}{100-8} - 44.91$$

Cull Cost Factor = 44.42 – 44.91 = –0.49

Cull Cost Factor	- 0.49
Total Cost Factor	- 4.29

Total Cost Factor = Dollar Factor
1.5

$$\frac{-4.29}{1.5} = +2.86$$

DOLLAR FACTOR rounded off to nearest $0.05 increment: plus 2.85

The dollar factor of plus $2.85 establishes that all coniferous green timber produced in the form of lumber or other manufactured products shall be assessed at the regulation rate of crown dues plus $2.85 per M F.B.M.

13.4.2

Example 2

(a) Average haul distance to trackage is 75 miles, 60 miles of which is on a Forestry road which is not maintained in the hauling season by the Forest Service, the remaining 15 miles are on private road.
(b) Average gross volume per acre = 17,000 f.b.m. per acre
(c) Average gross volume per tree = 210 f.b.m. per tree
(d) Average cull % = 15%

		CALCULATION OF CULL FACTOR	CALCULATION OF COST FACTOR
(1) HAUL AND ROAD COSTS			
A 75 miles		+1.78	+1.78
B 15 miles			- 1.04
C 60 miles			+2.40
(2) Average gross volume per acre	17,000 f.b.m.	- 1.05	- 1.05
(3) Average gross volume per tree	210 f.b.m.	- 5.40	- 5.40
Average cull 15 %	Total Base	+48.83	
Adjusted Variable Cost		44.16	

$$\text{Cull Cost Factor} = \frac{(\text{Total Base} + \text{Cost Factor}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

$$\text{Cull Cost Factor} = \frac{(\quad 44.16 \quad) \times 91}{100-15} - 35.90$$

Cull Cost Factor = 47.28 − 44.16 = +3.12

Cull Cost Factor	+3.12
Total Cost Factor	+0.19

Total Cost Factor = Dollar Factor
1.5

$$\frac{+0.19}{1.5} = -0.13$$

DOLLAR FACTOR rounded off to nearest $0.05 increment: minus 0.15

Revised April, 1967

13.4.3

Example 3

(a) Average haul distance to trackage is 65 miles, 30 miles of which is on a Government built and maintained highway.
(b) Average gross volume per acre (Sw & Pl) = 9,000 f.b.m./acre
(c) Average gross volume per tree (Sw & Pl) = 132 f.b.m./tree
(d) Average cull % (Sw & Pl) = 8%

		CALCULATION OF	
(1) HAUL AND ROAD COSTS		CULL FACTOR	COST FACTOR
A 65 miles		+0.37	+0.37
B 35 miles			+1.26
C miles			
(2) Average gross volume per acre 9,000 f.b.m.		+1.05	+1.05
(3) Average gross volume per tree 132 f.b.m.		0.00	0.00
Average cull 8 %	Total Base	48.83	
Adjusted Variable Cost		50.25	

$$\text{Cull Cost Factor} = \frac{(\text{Total Base} + \text{Cost Factor}) \times 91}{100-R} - \text{Adjusted Variable Cost}$$

$$\text{Cull Cost Factor} \frac{(\quad 50.25 \quad) \times 91}{100-8} - 50.25$$

Cull Cost Factor = 49.70 − 50.25 = −0.55

Cull Cost Factor	- 0.55
Total Cost Factor	+2.13

Total Cost Factor = Dollar Factor
1.5

$$\frac{+2.13}{1.5} = -1.42$$

DOLLAR FACTOR rounded off to nearest $0.05 increment: minus 1.40

Revised April, 1967

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

FOREST MANAGEMENT

SILVICULTURE

CHAPTER 18

Revised - February 1961

Revised April, 1967

FOREST MANAGEMENT
CHAPTER 18

SILVICULTURE

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CHAPTER 18

THE SILVICULTURAL MANAGEMENT OF ALBERTA'S CONIFEROUS FORESTS

18-221.09 Introduction:

Forest management has been defined as the practice or application of forestry in the conduct of a forest business. That is to say, it applies to the actual management of forest areas, all the theoretical principles of forestry in the light of the best business practices. It actually includes protection, silviculture, utilization and the policies of these as well as all others dealing with forestry. It is concerned with the organization of a forest area for management and with its maintenance, selecting in time and place the most advantageous use of the area, with the ultimate aim of securing a sustained yield. For many decades to come, forests in Alberta will have to be handled under methods which are a compromise between technical aims and practical necessity. Hence management is the compromising of business methods with technical forestry practices in the operation of a forest area. Therefore in defining silviculture the definition should read as follows: That part of forest management which deals with the techniques of establishing a desirable forest and controlling its growth.

The term "silvicultural system" designates the whole plan for silvicultural treatment during the life of the stand, including both reproduction and intermediate cuttings. The silvicultural system pertains to the tending and removing of stands and replacing them with new crops by natural and/or artificial means. The reproduction methods obviously have a decisive influence on the form and treatment of a stand and so much so that the name of the method is commonly applied to the silvicultural system, for example the partial (shelterwood) system involves use of the partial (shelterwood) method of cutting.

Many difference methods of reproduction have been developed, but they can all be reduced on analysis to a few standard methods. In practice the details of applying the same reproduction method may vary widely as they are altered for every species, forest region and objective of management. No single detailed procedure is the standard for each general method and variations may have a wide range in each method. The removal of the older timber and its replacement with a crop of young trees are the two major activities involved.

The four general reproduction methods follow:

A. Evenaged Stands

1. Clear cutting - removal of entire stand or block or patch in one cutting with reproduction obtained by natural seeding from adjacent stands, from cones in the slash or by artificial seeding or planting.

2. Seed block method - removal of timber in one cut except for small blocks of trees reserved as seed blocks.

3. Shelterwood (partial) method - removal of timber in a series of cuttings over a relatively short portion of the rotation period which encourages the establishment of reproduction under the partial shelter of seed trees.

B. Unevenaged Stands

4. Selection Method - removal of trees individually or in small groups at intervals over an indefinite period eventually resulting in unevenaged stand conditions.

As we are primarily concerned with coniferous stands in this province to date and the timber is considered to be generally evenaged, only the above three will be dealt with hereafter.

It is essential that there be definite objectives regarding the composition desired in new crops and the arrangement of the species whether by single trees, small or large tree groups or in pure stands. This requires high calibre planning measured in decades. Once the merit of a silvicultural plan of operation is thoroughly demonstrated, it should be followed.

The following illustrations, accompanying principles and information are purposely designed to be as simple as possible so that the fundamentals of each reproduction method would be readily understood. The basic approach you will note is a plan view, that is, a view from above so that each reproduction method and variations thereof may be readily compared.

18-221.01

A.

1. CLEAR CUTTING REPRODUCTION METHOD

The clear cutting reproduction method pertains to the removal of an entire stand or block or patch in one cutting with reproduction obtained by natural seeding from adjacent stands, from cones in the slash or by artificial seeding or planting.

Generally the perimeters of blocks or patches should be laid out in a flexible manner for adaption to topography, species composition and other forest conditions. Other primary considerations

governing both size and arrangement of patches also include:

(a) Timber conditions - remove less thrifty timber in the first cut.

(b) Exposure hazards - minimize as much as possible wind and other exposure hazards to the reserve timber. The better places to locate cutting boundaries are borders of natural openings, ridges, along old roads, seismic lines and breaks between age classes.

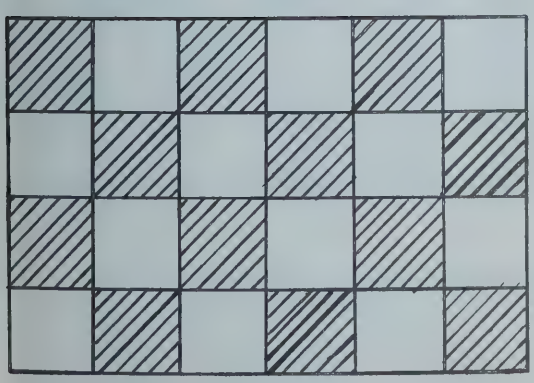
(c) Logging and road plans and mill locations - both the initial cut and the reserve (second) cut should fit into an orderly logging plan and road system and care is required in cut lay out planning to prevent the creation of costly or impractical blocks or tag ends. Certain road specifications should be adopted in rough country as a means of preventing soil erosion and improving water regulation.

It is of paramount significance that prompt restocking be regarded as at least equally important as the harvest. To induce the satisfactory establishment of desirable species, the present trend is towards scarification or other means to secure receptive seed beds.

The clear cutting system may only apply in this province where over 90% of the timber may be utilized, such as in a pulp cutting area or a saw log stand comprising above average diameter trees. To date, a large portion of the province yields saw logs only due to economic restrictions, hence the sheltered reproduction method is the only cutting method of general application and the clear cutting method would only apply in special areas. If, because of an excessive amount of decay or other serious factors, a clear cut rather than a partial cut of say 60% of total volume would be the only alternative in most instances.

(1) GRID CUT LAYOUT PLAN

(plan view)



First or initial area to be cut.

Reserve timber held for the second cut primarily allow regeneration to become established on the initial cutting areas.

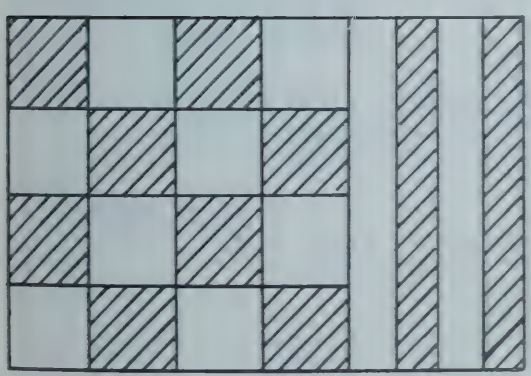
The grid cut layout pattern is a basic geometric plan which provides optimum size blocks with approximately equal acres of reserved timber.

The clear cutting method with 50% initial removal is illustrated above lends itself to improved protection from fire, insects and disease largely by the avoidance of areas of continuous slash. It also makes for improved water regulation and erosion control providing road layout is properly planned. Wind, exposure and other hazards should not be serious under normal conditions. The arrangment of the blocks, patches and strips should be planned out in such a manner as to promote the establishment of natural regeneration of desirable species in adequate numbers and satisfactory distribution. Fifty per cent removal also creates some aesthetic value particularly in comparison with 100% removal.

The above grid cut layout plan may be considered to be more theoretical than practical except possibly in flat country and with all other factors being equal. Variations in the above basic pattern are made due to the species composition, differences in timber types, topography, prevailing winds and other reasons. The essential differences in the application of the clear cutting method in this province is species composition; to wit pine may be reseeded from cones in the slash whereas spruces seed may be dispersed from the adjacent reserve timber.

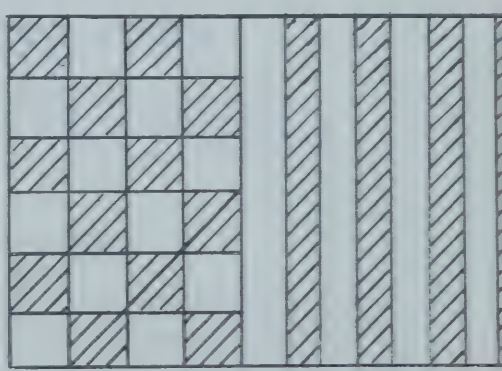
Two comparative illustrations in handling pine and spruce timber under the clear cutting system follow:

Pine



Alternate patches and alternate strips
Approx. min. size - 30 acres
Approx. max. size - 100 acres
Approx. optimum size - 70 acres

Spruce

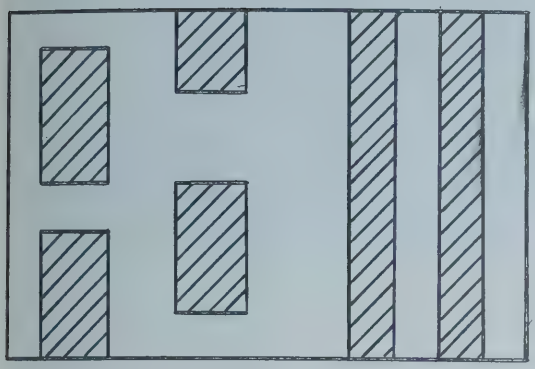


Alternate patches and alternate strips
Approx. min. size - 15 acres
Approx. max. size - 35 acres
Approx. optimum size - 25 acres

Revised April, 1967

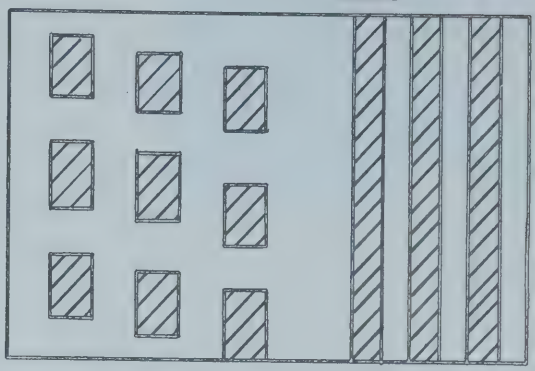
Other variations due to topography, wind, etc., follow:

Pine



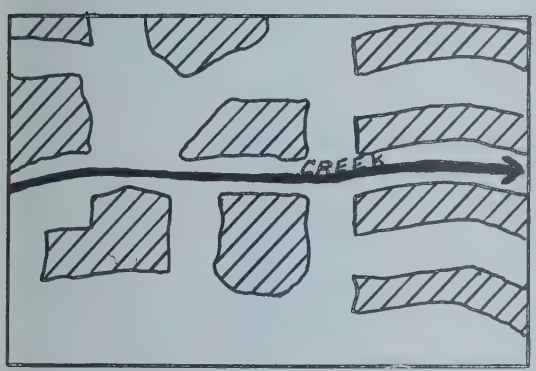
Prevailing winds

Spruce



Prevailing winds

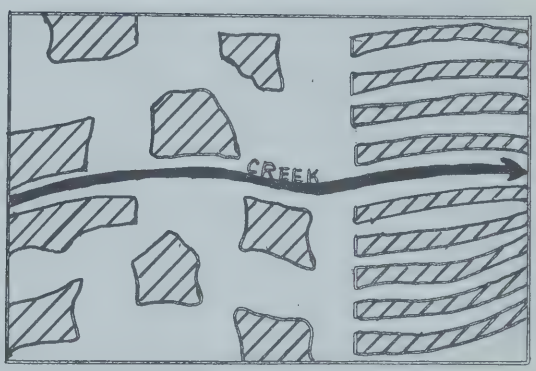
Pine



Rough topography

Note the fringe of timber retained parallel to the water course.

Spruce



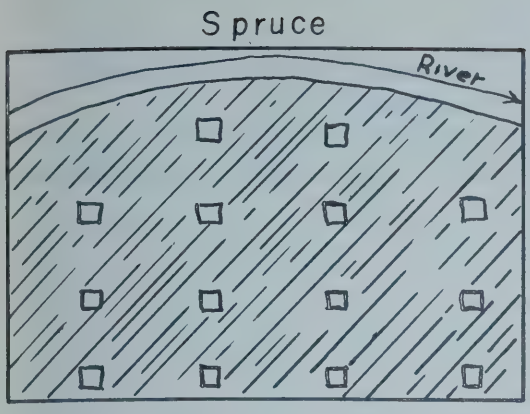
Rough topography

Note the fringe of timber retained parallel to the water course.

18.221.21

2. SEED BLOCK REPRODUCTION METHOD

The seed block reproduction method pertains to the removal of timber in one cut except for small blocks of trees reserved as seed blocks. Approximately 95% of the timber would be removed in the first cut and the reserve timber of 5% may or may not be removed by a second cut. The prime use of the reserve block is as a seed source and therefore it applies primarily to spruce. The use of this system in this province will only be on a limited scale, on lands with a minor slope and areas of low mean wind.



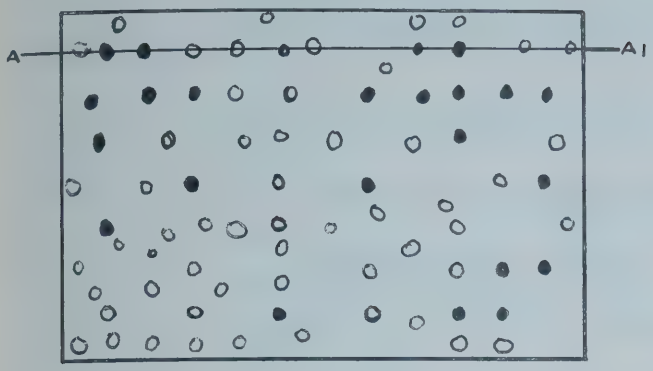
The illustration depicts a fringe of timber retained along a major water course and reserve seed blocks uniformly spaced through the cut over area. In actual practice, the seed blocks may be scattered rather than uniformly placed due to the forest conditio

18-221.02 3. SHELTERWOOD REPRODUCTION METHOD (PARTIAL CUTTING)

The shelterwood reproduction method concerns the removal of timber in a series of two and occasionally three or four cuttings over a relatively short portion of the rotation period and is partly designed to encourage the establishment of reproduction under the partial shelter of seed trees. Consequently, it is better suited to spruce silviculture where spruce seed is dispersed from seed trees and where a saw log economy dictate the removal of the larger trees. It is less suited to pine silviculture for the majority of pine seed is dispersed from cone-bearing slash lying on the groun rather than from standing trees. It is interesting to note that approximately 120° F. of heat is required to open pine cones.

Two means of tree designation for cutting are employed in this province with the basic aim of approximately 40% removal of total volume in the initial cut. The common system is the stump diameter cutting method whereby specific diameters are selected for each berth so as to cut approximately 40% of the merchantable volume leaving 60% for future cutti and as a seed source. The same volume guides are employed in marking individual trees for cutting. However, the major advantages of the tree marking system over the stump diameter system are the more regular distribut of stems and the achievement of a uniform crown canopy, thereby reducing the susceptibility of blowdown and other hazards. It makes for an improved reserve stand for future cuts. These differences are illustrated as follows:

Shelterwood - Stump Diameter
(40% removal)



● Cut Trees

o Reserve Trees

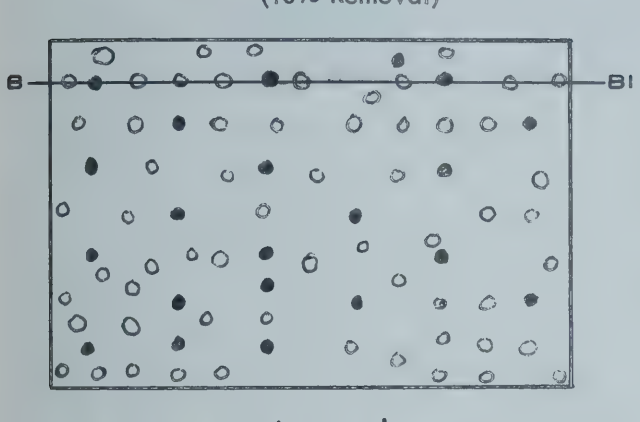
Note the irregularity by removal in s
distribution. Also unevenness in the
canopy would be obvious thereby lea
the reserve stand subject to exposure
other hazards.

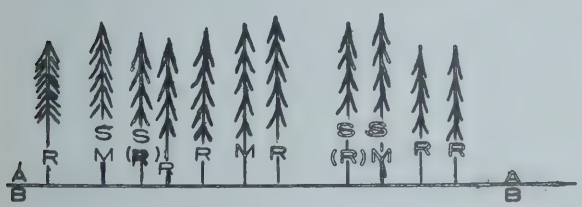
- trees to be cut (24 = ± 40% of tota
volum

- reserve trees (57 = ± 60% of total
volum

Marking trees for harvesting results i
improvement cut and an outstanding
reserve stand. This system is particu
suited to the boreal spruce region wh
the prime product is saw material.

Shelterwood - Marking
(40% Removal)





Cross-section to illustrate generally
all dominant trees are removed under
stump diameter limit system whereas
dominants, co-dominants and even so
intermediate trees would be removed
through improvement cutting under th
marking system.

A program is developing to increase
number of marking berths and reduce
number of diameter limit berths in th
province as a means of improving the
ment of our forests.

S - trees removed by stump
diameter limit
M - trees removed by tree
marking system
R - Reserve trees

B. UNEVENAGED STANDS

18-221.4

4. SELECTION REPRODUCTION METHOD

The selection reproduction method pertains to the remov
of the oldest or largest trees, either as single scattered trees or in small g
at relatively short intervals, commonly 5 to 20 years, repeated indefinitel

by means of which the continuous establishment of natural reproduction is encouraged and an unevenaged stand is maintained.

The use of this system is not favoured in this province and no further explanation appears necessary.

C. DEFINITIONS OF SOME OTHER CUTTING METHODS

IMPROVEMENT CUTTING - a cutting made in a stand past the sapling stage for the purpose of improving its composition and character, by removing trees of less desirable species, form and condition in the main crown canopy.

HARVEST CUTTING - A general term for the removal of financially or physically mature trees.

SALVAGE CUTTING - A cutting made to remove trees killed or injured by fire, insects, fungi or other harmful agencies (and sometimes trees susceptible to such injuries) for the purpose of preventing the spread of insects or disease.

FOREST MANAGEMENT

CHAPTER 18

REFORESTATION

18-233

INTRODUCTION

Timber production is the primary purpose of reforestation. Planting and/or seeding for watershed protection, or to improve recreation and wildlife conditions should, however, also be undertaken when needs for such measures are developed in systematic plans for management of these resources.

Reforestation helps to maintain favourable soil-cover conditions within our forests. Its aim is to produce optimum benefits from the forest in the form of firstly, wood products; and secondly, wildlife, recreation, and other related forest uses, as well as to maintain favourable conditions of stream flow.

PRIORITIES IN REFORESTATION

Emphasis should be placed upon reforestation in those parts of the country and on those sites where most favourable economic and social returns may be expected. These returns are ordinarily measured by the value and usefulness of the expected crop of timber. In some cases, other values such as watershed improvement or increased wildlife capacity, may outweigh timber production in determining emphasis.

Care of existing reforestation projects is of high priority. This involves protection from disease, insects, and animals, and release from competing inferior vegetation. It should take precedence over new reforestation projects.

Sites which are actively contributing to unfavourable conditions of stream flow should be reforested promptly where control of such destructive conditions is most effectively obtained by the planting or seeding of trees.

In determining the relative priority of other reforestation requirements, consideration should be given to multiple - use needs such as planting or seeding for timber production on critical watersheds, or correlating timber production with wildlife requirements and recreation use.

Productivity of site, accessibility, planting or seeding costs, prospects of success, and demonstrational value are factors to consider. Generally new burns should have high priority for prompt planting or seeding because conditions are then optimum to obtain high degree of survival and fast rate of growth at less cost if done before site deterioration

occurs and competing vegetation takes over.

Where production for forest products on nonstocked or partly-stocked lands is the important consideration, the following guides could apply:

a. In replanting or reseeding, advantage should be taken of knowledge gained from previous experience on the area to reduce losses.

b. Plant or seed on good sites on which it is reasonable to expect that valuable timber stands can be established.

c. Planting or seeding on nonstocked lands which would be classified as of lesser priority on the basis of anticipated returns, but on which delay in reforestation will substantially increase costs.

d. Planting or seeding on sites of relatively low productivity on which a timber cover is needed.

18-23 NATURAL vs ARTIFICIAL REGENERATION

Prompt and satisfactory establishment of reproduction is essential to successful timber management. The best method used in obtaining regeneration is a matter for local study and determination. Neither natural or artificial means have proven to be universally adaptable. The fact that a method has been found eminently satisfactory under a given set of conditions does not necessarily mean that it will prove similarly successful under another combination of conditions. Experience has shown that it is frequently difficult to recognize and measure the factors that contribute most to success or failure in obtaining regeneration. Choice between the use of natural and artificial regeneration hinges largely on practicability and cost.

18-231 NATURAL REGENERATION

Natural regeneration makes use of nature's methods, renewing the forest with species adapted to local climate and site. The result may be mixed forests which are less susceptible to mechanical injury by wind and other climatic conditions and are more resistant to damage by insects and disease than are the customary pure stands produced by artificial means.

Attempts at regeneration by natural means are not always successful. The factors most commonly limiting the effectiveness of measures to obtain natural reproduction are:

1. Lack of an adequate seed source, either in the form of seed stored in the duff*, seed from the area to be restocked, or seed from trees located on surrounding areas.

2. Presence of rodents or other animals or insects that eat the seeds or seedlings.

3. Site conditions which inhibit germination or subsequent survival of germinated seed.

Unless these factors can be controlled at costs less than those involved in artificially restocking, consideration should be given to the use of planting or seeding to obtain the desired regeneration.

Factors to be considered in measuring the possibilities for satisfactory natural regeneration, are:

a. Availability of seed - sufficient well-formed seed trees of preferred species should be available to adequately seed the area. Potential losses to rodents or seed-damaging insects and practical control methods should be considered.

b. Stocking - from a stocking standpoint, natural regeneration should result in a stand of desirable stems capable of making full use of the site at an early age. Poor stocking and incomplete use of site should be avoided.

c. Time - loss in production due to delay in obtaining regeneration is a factor that should be considered in planning the method of regeneration. Loss of production is measurable and can readily be interpreted in terms of cost. It will vary with the potential productivity of sites, indicating greatest production losses on best sites.

d. Weather - even though all other factors are favourable, natural regeneration often fails due to unfavourable climatic conditions.

18-232 ARTIFICIAL REGENERATION

Artificial regeneration is the establishment of forest cover by other than natural means.

The methods of artificially regenerating the forest stand are by planting and by seeding. For both of these methods a good supply of the best seed available is needed, or in other words, an appropriate supply of seed is the life-blood of a reforestation program. It is a basic requirement that must be fulfilled to support either a program of direct seeding or successful production of nursery stock. An appropriate supply of seed implies that the seed is of good quality, of the right species, of suitable origin, of reasonable cost, and that the supply is adequate to support

* Duff - Forest litter and other organic debris in various stages of decomposition on top of the mineral soil.

and that the supply is adequate to support a program of several years' duration as insurance against years of possible seed-crop failure.

18-232.312 Procurement of Seed

18-232.312.1

1. Seed Collection

Standards

Seed should be collected from:

1. Areas where plant associations are similar to those of the area to be seeded or planted.
2. Areas located in the same elevational range as that of the area to be seeded or planted.
3. Areas that are within a reasonable distance of the area to be seeded or planted (maximum, roughly 100 miles).

Investigations on seed source indicate that some leeway may be permitted in latitudinal range, but that elevational limits must be strictly observed. This is necessary, for example, to prevent frost damage to planted trees. Plants tend to maintain growth habits of their native locality, regardless of the climate in which they may be grown.

Seed should only be collected from trees having good phenotypical* characteristics. These are as follows:

trees having (a) straight stems
(b) slender branches with branches forming a right angle or near right angle with the stem
(c) narrow crowns
(d) self-pruning qualities
(e) vigorous growth
(f) superior resistance to disease and insect infestations.

Harvesting Seed

Procedure

The cone collection period is of short duration for spruce, usually not exceeding three weeks in any given locality. In pine, the period is much longer but it is preferred that the pine cones be not more than five years old.

Collectors may take cones from freshly felled trees on timber sale areas, or by climbing standing trees.

* Superior external qualities.

Collection from squirrel caches is of minor significance in most areas. Furthermore, cones found in such caches often contain unripe seed.

Collection from standing trees is a time-consuming and expensive operation, but is often times the only feasible means of obtaining cones of desired species and zone. Climbers must be equipped with a safety belt and rope, also with a hand tool for detaching cones which cannot be reached by hand. There are numerous types of handled picking tools. Basically, these tools are poles with an attached iron, shaped and sharpened for cutting or hooking cones.

Collection from freshly felled trees is one of the simplest and most economical methods of obtaining cones. Logging operations where trees of the desired species and within the desired seed collection zone are being felled during the seed ripening period afford almost unlimited opportunities to gather large quantities of cones. The most important point in gathering cones from felled trees is to be certain that the trees were not felled until after the seed was ripe, and that the cones have not been down so long that they have started to open and have lost a considerable portion of the seed.

Test for Seed Content of Cones

All cones harvested should contain sound ripe seed, in sufficient quantity to warrant collection. A widely accepted practice for appraising seed content of cones is to cut sample cones longitudinally through their centers with a sharp broad bladed tool, such as an axe. This exposes the cross sections of the seed and seed spaces on the faces of the two longitudinal halves. A count of the sound seed and unfilled seed spaces in the face of one longitudinal section permits calculation of a ratio between number of sound seed and total seed spaces exposed. This per cent is an index of seed content of a cone.

Cones must be of the current year crop in the case of spruce, and be from the seed zone specified. In pine, the cones must be at least 2 years old and preferably not more than 5 years old. Cones should not only be free from insects but should also be free from mold, twigs, and trash. Cone scales should not have opened to an extent that will permit loss of seed.

Test for Seed and Cone Maturity

Normally, the seed is ripe enough in the cones for harvest to begin when the seed coat is hard, it cannot be dented by the fingernail, and has become light brown in colour. The endosperm is firm, not milky, when squeezed.

Various grades of lubricating oil or other liquids of known specific gravity may be used for some species. This method has not been tried enough in this province to assure its accuracy. The method in the paragraph immediately above should be used until specific gravity methods can be thoroughly tested.

Sacking Cones

One of the best means of transporting cones from place of collection to the storage or extraction area is in sacks. Sacking prevents loss of seed from any cones that start to open and a sack of cones is light enough in weight to be easily handled. The best sack to use is the ordinary burlap feed sack. The sack must be free from holes and its strength not weakened by rot or mildew.

An identification tag must be fastened to the outside of the bag securely. This tag must show the L.S., Sec., T., R., W. Mer., Ranger Dist., date of collection, collector, and species. This information should be written on the tag in a medium that is not easily obliterated. Another tag should be put inside the bag in case the outer tag is lost.

Each sack must contain only the cones of a single species and zone.

Storing Cones

Each day's collection of spruce cones shall be delivered at the end of the day to a place where it can be stored in a cool, dry and shady place. A dry cellar makes an excellent storage place. In storing, sacks of spruce cones should be placed in an upright position, one layer thick. Crowding in storage prevents free circulation of air and aids the formation of mildew, fermentation leading to heating, and prior opening of cones. Sacked spruce cones may be close-stacked in shipment, if time in transit will be only a day, or less. For longer periods of transit, overcrowding of sacked cones should be avoided for the reasons cited above.

Storage of pine cones is not so difficult as they don't usually heat or mold in storage. However, it is best to store the cones in a cool dry place.

18-232.312.2

2. Seed Extraction and Processing

The principal steps in processing from cone to clean seed are:

a. drying to open cone scales to release imprisioned seed,

b. tumbling open cones to eject the seed,

c. dewinging to detach the wing from the seed,

d. cleaning to separate detached wings, chaff, and other debris from the seed, and

e. storage of seed.

a. Drying - Kiln drying and solar drying are the two methods most commonly used to open cones. Kiln drying is generally the required practice when large quantities of cones are to be dried and unfavourable climatic factors preclude solar drying.

b. Dewinging - Wings are still attached to the extracted seed. To reduce bulk in storing and to facilitate handling in sowing, it is customary to remove the wings. This treatment usually processes seed to an acceptable degree of purity.

c. Cleaning - The final step in processing the seed is to separate the seed from as much of the accompanying foreign material as possible. This is accomplished by screening out the heavier forms of material and blowing out the lighter forms and the hollow seeds. There are several types of seed cleaning fanning mills which effectively clean seed.

18-232.315 3. Seed Storage

Seed ordinarily must be stored for a number of years. The viability (germinative capacity) of seed decreases with the increase of elapsed time before sowing. The rate of decline is materially affected by the moisture content of the seed at the time it is placed in storage, also it is affected by moisture and temperature conditions maintained throughout the storage period. Important factors in seed storage are:

a. The seed must not be collected until ripe.

b. The seed should be dried to 6 to 10 percent moisture content.

c. Cold storage must start as soon after drying as possible.

d. Containers must be airtight and be of a size that permits easy handling and storage.

e. Storage temperature must be maintained in the range of 32° to 41° F. and not higher than 41° F.

f. The seed must be used as soon as possible after removal from cold storage.

The critical storage factors mentioned require storage facilities that are not available in most areas. All seed collected, even though intended for specific projects, should therefore be forwarded to a central seed bank for storage. Seed placed in this storage bank is to be properly labelled and segregated so that it may be returned to the same area upon request.

18-232.32 Production of Planting Stock

18-232.323 1. Seed Sowing

Seed is sown at a nursery in seedbeds. The generally accepted definition of a seedbed is that it is a strip of ground four feet wide and of any length that best suits cultural operations.

Time Seed may be sown either in the fall or in the spring. Fall sowing usually results in early, fast, and uniform germination in the spring, as the natural seed dormancy is overcome by the overwinter exposure in the seedbeds. In the spring, sowing should be done as soon as the ground can be cultivated. Spring sowing usually results in much later germination than fall sowing and is not always uniform, unless seed is stratified prior to sowing. Stratification is a means employed to break embryo dormancy in seed prior to sowing by pregerminating the seed in a moisture-retaining media such as sterile sand or vermiculite (a mica product) and exposing the seed and media mixture for a period of 60 to 90 days to a temperature of 32° to 41° F.

Method Seed may be sown either in drills or broadcast, and either by hand or machine. On the average, seedlings from broadcast sowing apparently make the best individual development and are more uniform in size.

Density Sowing density refers to the number of trees that are to be grown per unit of area. The general practice, so that neither space nor seed is wasted, is to produce on a given unit of area as many trees as possible of a desired size and quality.

18-232.325 2. Cultural Practices

The soil at a nursery has to be prepared in much the same way as on a farm. Watering facilities are a necessity to ensure seedling survival in times of drought, as is artificial shading.

The nursery has to be kept free of weeds by various methods, i.e., hand picking, chemical spraying, etc.

Covering seedbeds and small trees with some protective material, such as paper, burlap, needles or straw, etc., is known as mulching. It is practiced when necessary to prevent frost heaving, to minimize soil moisture losses from evaporation, to prevent wind movement of topsoil and to prevent severe dehydration of small trees.

Fertilizing, in order to give the proper nutritional balance to the seedlings, is practiced in most nurseries.

Transplanting is usually done after one, two, or three years in the seedbed.

When transplanted seedlings or seedlings directly out of seedbeds are being prepared for out-planting they are culled and packed in bales. It is better to take theseedlingsdirectly to the planting area, rather than store them, but this is not always possible.

PLANTING AND SEEDING

18-232.4

Planting

Many failures in planting may be traced to the lack of treatment of the site prior to planting. Site preparation usually involves the treatment of the soil or vegetative cover or both.

There are various methods of pretreating areas to be planted such as: Prescribed burning - relatively cheap: Brush elimination - by using bulldozers, herbicides and by plowing: Scalping - using tools to bare the spot being planted.

Planting nursery-grown trees is a dependable method in some areas but very expensive. The goal in planting is to obtain a high rate of survival rather than planting a large number of trees in a specific period. Each tree planted must be set with sufficient attention to good practice to ensure survival and satisfactory growth.

In all situations, the best planting techniques depend for complete success upon the correct choice of species, seed source, and spacing in relation to the planting objectives, and upon the delivery of satisfactory nursery stock.

The main method of planting in this province is to use hand tools. They are utilized in making holes, slits, etc., in which the seedling is planted.

18-232.33

Seeding

Seeding offers more flexibility to a reforestation plan than does planting. It permits work to be carried on during a much longer season and under more variable conditions.

Experience has shown that direct seeding is practicable and most likely to be successful only when the seed is placed in contact with mineral soil and is protected from rodents and birds.

Either stratified or unstratified seed may be used in direct seeding. Seeds are stratified to overcome dormancy so that germination will start almost immediately after seeds are sown.

Broadcast Sowing

The seed is scattered over the area either by hand, by hand-operated mechanical seeders, or possibly by aircraft. Hand broadcasting is more applicable in treatment of relatively small areas.

The amount of seed to be distributed per unit of area in broadcast sowing is influenced by a series of controlling factors: Density of seedling establishment desired, cost per pound of seed, germinative capacity of seed, surface conditions of site, and rodent and bird populations. If no pretreatment is done, more seed will be needed to offset the wasted seed that

falls where germination is not possible.

Seed Spot Sowing

In this method of direct seeding, a given number of seeds are dropped in a shallow hole or "spot" and covered with soil. Generally, the interval between spots is the same as the standard spacings employed in planting. Seed spot sowing is performed either by hand or by hand-operated mechanical seeding devices. The number of seeds to sow per spot is based on the germinative capacity of the seed used. If stratified seed is used, a smaller number of seeds is necessary (under favourable weather conditions) because better germination can usually be expected.

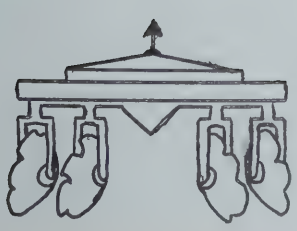
Various hand-operated mechanical seeding devices work well for spot sowing. They are light enough to carry by hand and have a container for seed connected by channel with the dispensing point. A man can spot seed approximately one acre per hour with this type of seeder.

The most favourable spots should be selected for sowing; spots favourable for germination and seedling growth are far more important than exact spacing between spots. Advantage should be taken of spots in shade of logs, unless the logs have bark which will slough off or stumps or rocks are present. Mounds or ridges of loose soil, accumulations of rotten wood or other trash, and spots within two feet of dense vegetation or growing trees should be avoided.

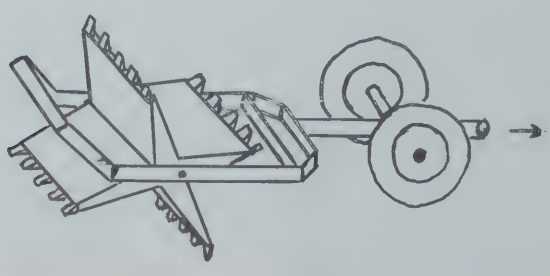
18-232.2 + 232.33

Scarification and Seeding

In the event of a good seed year of the more valuable species, such as pine and white spruce, areas may be scarified to take advantage of the natural seed fall. Scarification means the breaking up of the forest floor and topsoil preparatory to natural regeneration or direct seeding. This scarification can be done by various means but the more common type of machine is the caterpillar with a blade. (Other machines used by the A.F.S. are the Imset Scarifier and Athens plow, see Figure 1). Attaching some type of teeth to the dozer blade is preferred to a plain blade for the teeth help to mix the duff and humus layer with the mineral soil - this mixing produces a better seed bed.



Athens Plow



Imset Scarifier

The purpose of the caterpillar with blade is to scalp the duff layer and other debris down to bare mineral soil, producing a favourable seed bed. These scalped areas should be ten to fifteen feet apart and well distributed over the entire scarification area. With good seed distribution on each spot, a good stand of timber should result. This, of course, is subject to many factors such as; frost heaval and drought, which would possibly kill the seedlings; and insects and disease, which may attack the trees in their later lives.

In the event of a poor seed year, areas can be scarified and seeded. This seeding is usually referred to as direct seeding with the seed applied directly to the scarified spot. As has been noted before, if you have a supply of good seed a more versatile program can be anticipated - this direct seeding illustrates the point.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

FOREST MANAGEMENT

STANDARD DIMENSIONS AND OTHER SPECIFICATIONS

CHAPTER 19

Revised April, 1967

FOREST MANAGEMENT

CHAPTER 19

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FOREST MANAGEMENT

STANDARD DIMENSIONS AND OTHER SPECIFICATIONS

CHAPTER 19

19.1 Introduction

This chapter is designed to provide general information regarding the manufacture and other aspects of the forest industry and also to properly assess timber dues. It is not intended as a grading rule; however, certain sizes are at times required before some products attain a grade. Also it is not the intent to limit or hinder any operator but rather to encourage good utilization and eliminate waste.

Four different methods are presently employed by the Department to assess timber dues on forest products. The basis of each method is as follows:-

(a) tree scale
(b) log scale
(c) volumes reported manufactured
(d) volumes reported sold

These specifications in this chapter are to be used in all cases when dues are assessed on volumes sold, and in the calculation of volumes reported manufactured for comparison with log or tree scale.

This revised print of Chapter 19 dated April 1967 supersedes all original copies (dated August, 1961 and August 1962 revision) that were previously furnished to all active lessees, licensees and permittees.

Your attention is directed to Section 19.4 of this Chapter regarding lumber specifications, particularly of dimension lumber, that are acceptable to the Department when determining volumes to be reported on timber returns for dues collection. Previously this ruling was questioned by the executive of the Alberta Forest Products Association and resulted in a meeting held April 13, 1962 between representatives of the association and the Department. The following procedure was decided upon at the meeting:

1. All lessees, licensees and permittees who manufacture lumber to standard sizes and pay their dues on the basis of volumes sold shall calculate the volumes to be reported on returns in accordance to the standards as specified in Section 19.4 of this chapter.

2. A licensee or permittee not on log or tree scale and not in agreement with reporting as stated in (1) shall before commencing manufacture:

(a) make application to the Department to operate on the basis of the 5/16 Inch International Log Scale system at an early date, or

(b) contact the Department for a ruling upon which to determine and report volumes sold on returns. Such ruling must be obtained from the Department well in advance of commencing manufacture, otherwise the standards as specified in Section 19.4 of this chapter must apply.

The dimension lumber specifications set out in Section 19.4 of this chapter were reviewed the latter part of 1966. Agreement was reached with the Alberta Forest Products Association in January, 1967, as an interim measure, to amend these specifications as are delineated in Section 19.4 with the understanding that further negotiations would be considered if found necessary pending the ultimate outcome of American Lumber Standards and Canadian Standards Association committee's negotiations on standard sizes.

Further details or information may be secured from the Director of Forestry, Department of Lands and Forests, Natural Resources Building, Edmonton or from your local forest division office.

The Forests Act requires that dues shall be paid on all timber cut on Crown Land.

Some dealers take an allowance in the form of dockage from vendors to compensate for poorly manufactured material, excessive bark etc.

It is suggested that quality buying should supplant this procedure.

The Department does not recognize dockage and the vendor must report and pay dues on the gross volume of material sold.

19.2 NOMENCLATURE OF ALBERTA'S COMMERCIAL WOODS

19.2.1 (a) Commercial Softwoods (coniferous species)

Standard Commercial Name	Other Common Names	Botanical Name
Alpine Fir	White Fir True Fir	Abies lasiocarpa (Hook.) Nutt.
Balsam Fir	Fir Balsam	Abies balsamea (L) Mill.
Douglas Fir	Rocky Mtn. Douglas Fir Mountain Fir	Pseudotsuga menziesii (Mirb.) Franco
Jack Pine	Banksiana Pine Princess Pine	Pinus banksiana Lamb.
Lodgepole Pine	Western Pine	Pinus contorta Loudon var. latifolia Engelm.
Black Spruce	Swamp Spruce	Picea mariana (Mill.) BSP
Engelmann Spruce	Mountain Spruce	Picea engelmanii Parry
White Spruce	Northern Spruce Cat Spruce	Picea glauca (Moench) Voss
Western White Spruce	Alberta Spruce White Spruce	Picea glauca (Moench) Voss var. albertiana (S. Brown) Sarg.
Tamarack	Larch Eastern Larch Hackmatack	Larix Laricina (Du Roi) K. Koch

19.2.2 (b) Commercial Hardwood (deciduous species)

Aspen	White poplar Aspen poplar Trembling Aspen	Populus tremuloides Michx.
Balsam Poplar	Black poplar Balm Poplar	Populus balsamifera L.
White Birch	Birch Paper birch	Betula papyrifera Marsh.

19.3 PRODUCTS

19.3.1 Basic Products

This chapter will be concerned with the following basic products covered in the General Rates of Dues.

Lumber
Lath
Railway Ties
Mine Ties
Round Timber (All types - posts, piles, etc.)

19.3.2 Other Products

Sometimes basic products are converted or manufactured into something else before the basic products are reported sold. Some are:

Grain Doors
Coal Doors

To determine the accountable volume content we must know what material actually went into its manufacture. These will be dealt with in a later section.

19.4 LUMBER CLASSIFICATIONS

19.4.1 Lumber is a manufactured product derived from a log in a sawmill.

19.4.2 Rough Lumber - not dressed (surfaced) but sawed, edged and trimmed at least to the extent of showing saw marks in the wood on the four longitudinal surfaces of each piece for its overall length.

19.4.3 Dressed (surfaced) lumber has been surfaced by a planing machine (for purposes of attaining smoothness of surface and uniformity of size) on one side (S1S), two sides (S2S) one edge (S1E) two edges (S2E) or a combination of sides and edges (S1S1E) (S1S2E) S2S1E) or S4S).

19.4.4 Worked Lumber

19.4.4.1 Definition - worked lumber in addition to being dressed, has been matched, shiplapped or patterned.

19.4.4.2 Matched Lumber - has been worked with a tongue on one edge of each piece and a groove on the opposite edge, to provide a close tongue and groove joint by fitting two pieces together; when end-matched, the tongue and groove are also worked on the ends.

19.4.4.3 Shiplapped Lumber - has been worked or rabbited on both edges of each piece to provide a close lapped joint by fitting two pieces together.

19.4.4.4 Patterned Lumber - is shaped to a pattern or to a molded form, in addition to being dressed, matched or shiplapped or any combination of these workings.

19.4.5 General Terminology of Lumber

19.4.5.1 NOMINAL - is defined as existing in name only, not actual or real, applied to timber or lumber, it is rough sawed commercial size by which it is known and sold on the market e.g. a finished 1" x 6" actually measures 3/4" x 5 1/2" or 25/32" x 5 1/2", the nominal size of rough lumber from which it is manufactured would be 1" x 6".

19.4.5.2 BOARDS - includes lumber less than 2" nominal in thickness and 2 or more inches in width. Boards less than 6 inches wide may be classified as strips.

19.4.5.3 DIMENSION - includes lumber from 2" up to but not including 5" in nominal thickness and 2 or more inches in nominal width. The above definition specifies nominal thickness. Thus the actual thickness of nominal two inch material is much less and in some instances may barely exceed that of boards. Dimension lumber may be classified as joists, planks, studs, rafters, cribbing etc., that is manufactured for sale with four flat sides.

19.4.5.4 Timbers - sawed material 5" or more nominal inches in least dimension. Timber may be classified as beams, stringers, sills, girders, etc.

19.4.6 Measurement and Tally of Lumber

19.4.6.1 Feet Board Measure - shall be used as the unit of measurement. (The number of board feet in a piece is obtained by multiplying the nominal thickness in inches by the nominal width in inches by the nominal length in feet and dividing by 12.)

19.4.6.2 Dressed Thickness and Widths of lumber specified in Section 19.4.8.5 shall be considered minimum standards for the corresponding nominal size as shown. Lumber rough or dressed, green or dry shall be described and tallied by its nominal dimension.

19.4.6.3 The board measure of dressed lumber of standard size shall be based upon the corresponding standard dimensions of rough lumber.

19.4.6.4 Tallying Lumber - is a record of the number of pieces of lumber in a pile or on a truck, by width, thickness, and length of its pieces.

19.4.6.5 Block Scale - is established by multiplying the nominal width in inches by the nominal height in inches by the average length in feet and dividing by 12. To establish the nominal width of a load or pile, count the number of pieces in an average tier and multiply by the nominal width of the pieces. To determine the height count the number of tiers and multiply by the nominal thickness of the pieces.

19.4.6.6 Width and thickness measurements in all cases should be made at least 18" from the end of the board to allow for end variation.

19.4.6.7 Lengths - shall be in multiplies of 2' except precision cut stock or special orders.

19.4.6.8 Trim - trim allowance for sawlogs shall not be less than 2 inches or greater than 6 inches over the even foot. Four inches in the optimum allowance for untrimmed lumber.

19.4.7 STANDARD LUMBER ABBREVIATIONS

DET	- Double End Trimmed
Dim	- Dimension
E	- Edge
EE	- Eased Edge
EG	- Edge-grain (vertical grain)
FG	- Flat or slash grain
ft.	- Foot or feet
ft. b.m. or f.b.m.	- Feet board measure
ft. s.m.	- Feet surface measure
G (or GR)	- Green
H & M	- Hit and Miss
KD	- Kiln Dried
Lbr.	- Lumber
Lgr.	- Longer
Lgth.	- Length
Lin. ft.	- Lineal foot or feet
Lth.	- Lath
M.b.m. or MBM or M ft. b.m.	- Thousand feet board measure
MG	- Mixed grain
M.L.	- Mixed lengths
MR	- Mill run
M s.m.	- Thousand feet surface measure
m.w.	- Mixed widths
P.	- Planed
PAD	- Part air dried
Pc.	- Piece
rdm.	- Random
res or R/S	- Resawn or resawed
Rgh.	- Rough
r.l. or R./L.	- Random lengths
r.w. or R./W.	- Random widths
r.w. & l.	- Random widths and lengths
S1E	- Surfaced one edge
S1S	- Surfaced one side
s.f.	- Surface foot, i.e. one square foot
Sftwd.	- Softwood
SM.	- Surface measure
T & G	- Tongue and groove
Tbrs.	- Timbers
S4S	- Surfaced four sides
SS	- Surfaced two sides

19.4.8 Lumber Sizes

19.4.8.1 Resaw - the Department recognizes a resaw either at the sawmill or planer as an extension of the sawmill. The thickness of rough dimension lumber manufactured for resaw purposes will be slightly thicker than required for standard S4S dimension to allow for the resaw kerf and surface planing. The foregoing only applies while the lumber remains in the possession of the Licensee or Permittee. The additional thickness of material required for resaw purposes and surfacing is not intended as a thickness that may be considered free of dues when sold if not so utilized while in a Licensee's or Permittee's possession. Lumber that is sold in the rough, green or dry, the volume reported must be determined as set out in Section 19.4.8.3.

19.4.8.2 Tolerance thickness - an allowance of one-eighth of an inch in thickness of green material over nominal size of rough dimension is sufficient to allow for drying (1/16th of an inch per inch of thickness). This allowance would provide ample material after shrinkage for resaw manufacture of 2" nominal dimension lumber into two pieces dressed S4S 1" nominal lumber (2 pcs. 25/32" or 24/32").

Widths are somewhat different, dressed sizes of dimension lumber and timbers are 1/2" scant on widths 6" and wider while the narrower widths of 5" or less of common boards, dimension lumber and timbers are 3/8" scant of nominal width.

Softwood lumber shrinks and swells within narrow units in widths and thickness, averaging approximately 4%.

To saw material of a uniform thickness and width that is not excessive nor scant the Sawyer must keep the sawmill in proper alignment and know the purpose for which the manufacture is intended, that is:

1. (a) the end product specifications
   (b) to plane green or dry, and
   (c) to resaw or not

Any abnormal variation in the sawn thickness or width should be rectified at the earliest.

19.4.8.3 Diagram Rules - the specifications delineated under sub-section 19.4.8.5 are the accepted thickness and widths of lumber and are self-explanatory however, the following will apply:

Combinations of dressed sizes for the purpose of lowering dues will not be tolerated.

If the nominal thickness exceeds the quarter inch then the next highest quarter inch size will be used to determine the volume content.

The specifications described below in this section apply to dimension lumber only (refer Section 19.4.5.3 Dimension Terminology). In the case of special or unusual sizes in dressed lumber the dues on the volume content shall be assessed on the basis of the nominal size so utilized.

1. (a) Where the dressed dimension lumber measures 1 19/32 inches but not greater than 1 24/32 inches in thickness, the dues on the dimension content will be assessed on the basis of an 8/4" count. The maximum thickness may be increased to 1 30/32 inches on a hit and miss basis in low grade material for the production of elevator cribbing, etc.

(b) Where the dressed dimension lumber measures less than 1 19/32 inches but more than 1 13/32 inches in thickness, the dues on the dimension content will be assessed on the basis of a 7/4" count. When the product manufactured is other than standard dimension (framing) and is shipped to recognized Alberta Forest Products Association standard sizes, the 1 19/32 inches in thickness will be recognized as 7/4" for dues assessment purposes providing invoicing to customer is on that basis.

The scant dimension lumber thickness accepted by the Federal Housing Administration, which results in a reduction in the thickness of dressed S4S dimension from 1 20/32 inches to 1 16/32 inches or 1 18/32 inches, will be considered by the Department as 7/4" material for dues assessment.

(c) Where the dressed dimension lumber is comprised of material that measures 1 13/32 inches or less but more than 1 5/32 inches in thickness, the assessment of dues will be on the basis of a 6/4" count.

The thickness designated above for each size of product to apply regardless of moisture content, green or dry. The thickness shown for each dimension lumber product is in accordance with that set out in this chapter as previously revised August, 1962 except for the minimum and maximum limits of 8/4" and 7/4" stock which is intended to cover hit and miss dressing and material manufactured for special orders such as elevator cribbing.

Products other than dimension lumber will be evaluated on an individual basis.

Where the dimension lumber is dressed the above specification will apply, however, the Department may increase the count where the rough sawn sizes for normal use are in excess of those given below:

To Plane Dry	Nominal Thickness	Standard Dressed Thickness	Approx. Shrinkage	Surfacing Loss	Variation in Sawing	Rough Green Dimension Thickness
"	8/4"	1 20/32"	4/32"	4/32"	4/32"	2"
"	7/4"	1 18/32"	4/32"	4/32"	4/32"	1 30/32"
"	6/4"	1 13/32"	3/32"	4/32"	4/32"	1 24/32"

A shrinkage factor of 2/32 of an inch per inch of thickness is included in the above rough green measurements. This tolerance for shrinkage would not be required for material that is dressed to standard thickness and shipped while green. A tolerance to allow for variation in sawing is also included in the rough sawn thickness of each product and thus the thickness of each size shown may be considered the maximum required except for stock designated for resaw purposes. Resaw material would require a thickness for saw kerf and surfacing in addition to that shown in the foregoing rough sawn table, the amount of which would of course depend on whether the material is processed green or dry.

19.4.8.4 Dressed Green or Dry Lumber Sizes in Relation to Nominal Sizes

A. Thickness in Inches

Nominal Thickness	Common Boards — Standard Dressed Thickness	Dimension Lumber and Timbers — Standard Dressed Thickness	Others - Thickness Minimum	Others - Thickness Maximum
1 or 4/4	2 pcs. 3/8 or 7/16 S1S 1 pc. 3/4 or 25/32 S2S 1 pc. 15/16 H & M			
1 1/4 or 5/4	2 pcs. 1/2 S1S	1 pc. 1 1/16 S2S	1 pc. 30/32 S2S to 1 5/32 S1S	
1 1/2 or 6/4	2 pcs. 11/16 or 21/32 S1S	1 pc. 1 3/8 S2S	1 pc. 1 3/16 S2S to 1 13/32 H & M	
1 3/4 or 7/4	2 pcs. 3/4 S1S	1 pc. 1 9/16 S2S	1 pc. 1 7/16 S2S to 1 9/16 S2S	
2 or 8/4		1 pc. 1 5/8 S2S	1 pc. 1 19/32 H & M to * 1 30/32 H & M	
2 1/4 or 9/4			1 pc. 1 30/32 S2S to 2 4/32 H & M	
2 1/2 or 10/4			1 pc. 2 4/32 S2S to 2 12/32 S1S	
2 3/4 or 11/4			1 pc. 2 12/32 S2S to 2 20/32 S1S	
3 or 12/4		1 pc. 2 5/8 S2S	1 pc. 2 20/32 S2S to 28/32 H & M	
4 or 16/4		1 pc. 3 5/8 S2S	1 pc. 3 3/4 S2S	
5		1 pc. 4 5/8 S2S		
6		1 pc. 5 1/2 S2S		
		6" and up 1/2" scant of nominal		

* Underlined item may be assessable for dues at higher nominal size - Refer Sub-Section 19.4.8.3, 1 (a).

19.4.8.4 Continued

B. Widths in Inches

Nominal Width	Common Boards: Maximum Rough Green	Common Boards: Standard Dressed Width S2E	Dimension Lumber and Timbers: Maximum Rough Green	Dimension Lumber and Timbers: Standard Dressed Width S2E
2	2	1 5/8	2	1 5/8
3	3 1/16	2 5/8	3 1/16	2 5/8
4	4 1/8	3 5/8	4 1/8	3 5/8
5	5 3/16	4 5/8	5 3/16	4 5/8
6	6 1/8	5 1/2	6 1/8	5 1/2
7	7 3/16	6 1/2	7 3/16	6 1/2
8	8 1/4	7 1/2	8 1/4	7 1/2
9	9 5/16	8 1/2	9 5/16	8 1/2
10	10 3/8	9 1/2	10 3/8	9 1/2
11	11 7/16	10 1/2	11 7/16	10 1/2
12	12 1/2	11 1/2	12 1/2	11 1/2

Included in each above rough green width measurement is an allowance of 1/16" per inch for shrinkage, 2/16" for planing and 2/16" variation in sawing. On special dressed widths of 3/8" or 1/4" scant of nominal the rough green size would vary accordingly. For further information on specific width sizes of pattern and other stock refer to grading rules employed by the Alberta Forest Products Association.

19.4.8.5 STANDARD THICKNESS - only thickness sizes are to scale.

	Nominal size and basis for dues not including tolerance for drying and resaw cut.	Actual minimum rough wood required not including resaw cut.	Finished Product.
	4/4" Stock		
(a)	1" Rough Wood	28/32" Rough Wood	1 pc. 3/8" S1S 1 pc. 3/8" S1S
	4/4" Stock		
(b)	1" Rough Wood	32/32" Rough Wood	1 pc. 7/16" S1S 1 pc. 7/16" S1S
	4/4" Stock		
(c)	1" Rough Wood	28/32" Rough Wood	1 pc. 3/4" S4S
	4/4" Stock		
(d)	1" Rough Wood	29/32" Rough Wood	1 pc. 25/32" S4S
	4/4" Stock		
(e)	1" Rough Wood	32/32" Rough Wood	1 pc. 15/16" H & M

Figure 1 (a, b, c, d and e)

Nominal size and basis for dues not including tolerance for drying and resaw cut.	Actual minimum rough wood required not including resaw cut.	Finished Product.

5/4" Stock

(a) 1 1/4" Rough Wood → 36/32 Rough Wood → 1 pc. 1/2" S1S; 1 pc. 1/2" S1S

5/4" Stock

(b) 1 1/4" Rough Wood → 38/32" Rough Wood → 1 pc. 1 1/16" S2S

5/4" Stock

(c) 1 1/4" Rough Wood → 40/32" Rough Wood → 1 pc. 1 1/8" S2S

5/4" Stock

(d) 1 1/4" Rough Wood → 41/32" Rough Wood → 1 pc. 1 5/32" S1S

Figure 2 (a, b, c & d)

	Nominal size and basic for dues not including tolerance for drying and resaw cut.	Actual minimum rough wood required not including resaw cut.	Finished product.
	6/4" Stock		
(a)	1 1/2" Rough Wood	46/32" Rough Wood	1 pc. 21/32" S1S 1 pc. 21/32" S1S
	6/4" Stock		
(b)	1 1/2" Rough Wood	48/32" Rough Wood	1 pc. 11/16" S1S 1 pc. 11/16" S1S
	6/4" Stock		
(c)	1 1/2" Rough Wood	48/32" Rough Wood	1 pc. 1 3/8" S2S
	6/4" Stock		
(d)	1 1/2" Rough Wood	49/32" Rough Wood	1 pc. 1 13/32" S2S

Figure 3, (a, b, c, & d)

	Nominal size and basis for dues not including tolerance for drying and resaw cut.	Actual minimum rough wood required not including resaw cut	Finished product.
	7/4" Stock		
(a)	1 3/4" Rough Wood	52/32" Rough Wood	1 pc. 3/4" S1S 1 pc. 3/4" S1S
	7/4" Stock		
(b)	1 3/4" Rough Wood	52/32" Rough Wood	1 pc. * 1 16/32 S2S
	7/4" Stock		
(c)	1 3/4" Rough Wood	54/32"Rough Wood	1 pc. 1 18/32" S2S

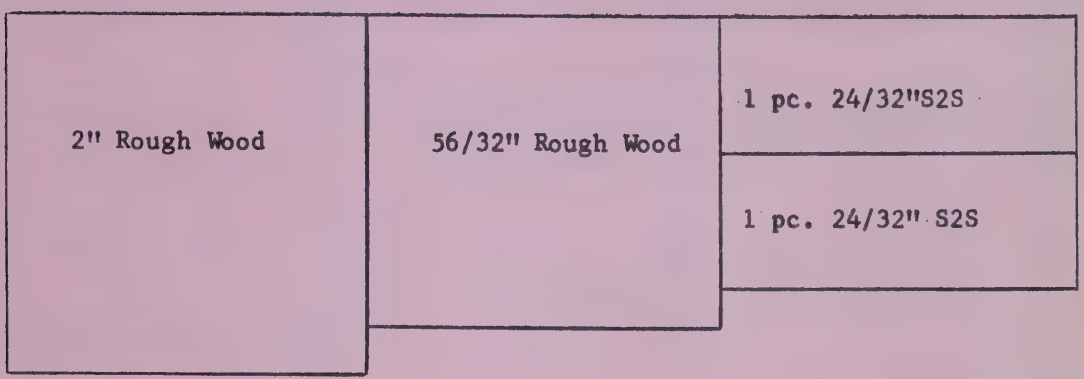
Figure 4, (a, b & c)

*Refer stipulation sub-section 19.4.8.3, 1 (b).

Nominal size and basis for dues not including tolerance for drying and resaw cut.	Actual minimum rough wood required not including resaw cut.	Finished product.

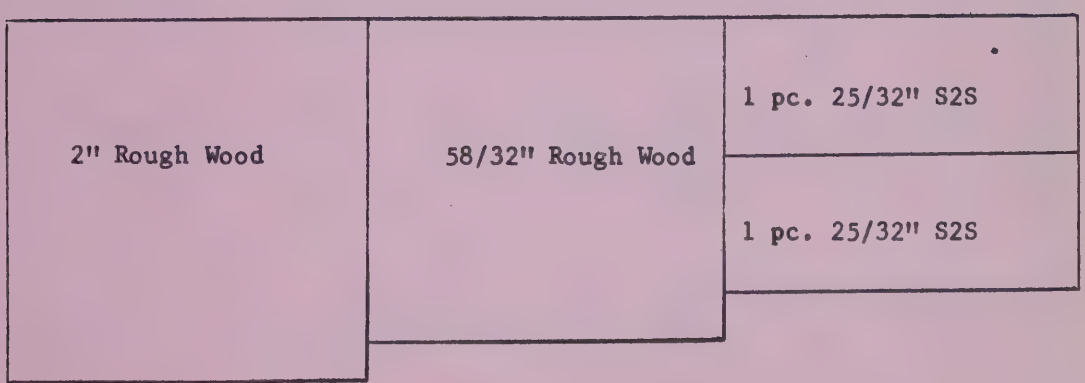
8/4" Stock

(a)



8/4" Stock

(b)



8/4" Stock

(c)

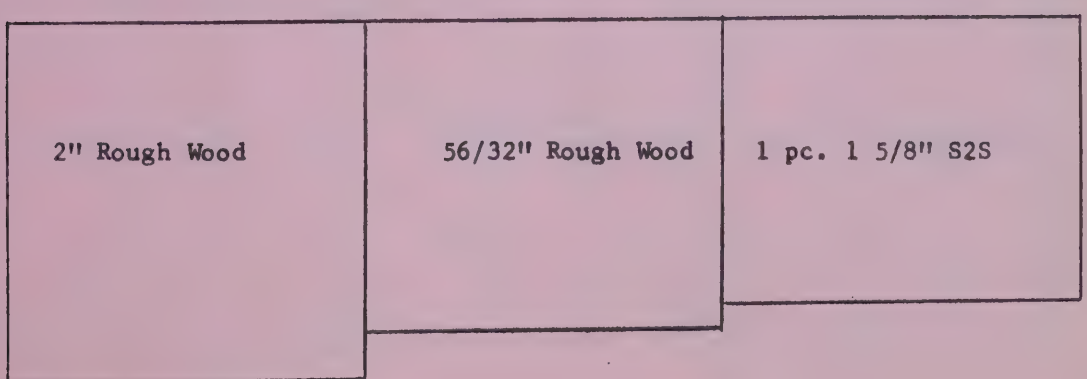


Figure 5, (a, b & c)

Cont'd. .....
Figure 5A

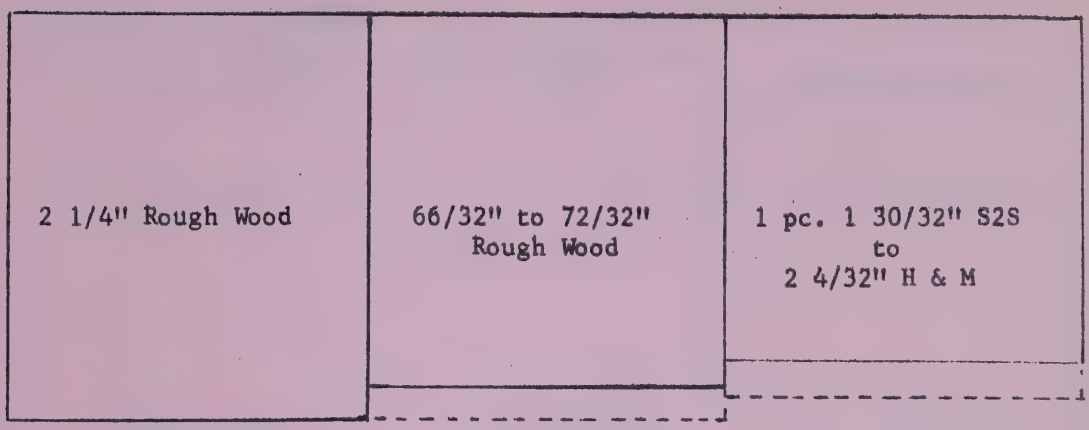
Nominal size and basis for dues not including tolerance for drying.	Actual minimum rough wood required.	Finished product.
8/4" Stock		
(d) 2" Rough Wood	55/32" Rough Wood	1 pc. * 1 19/32" S2S
8/4" Stock		
(e) 2" Rough Wood	60/32" Rough Wood	1 pc. 1 3/4" S2S
8/4" Stock		
(f) 2" Rough Wood	62/32" Rough Wood	1 pc. * 1 30/32" H&M

Figure 5A, (d, e & f)

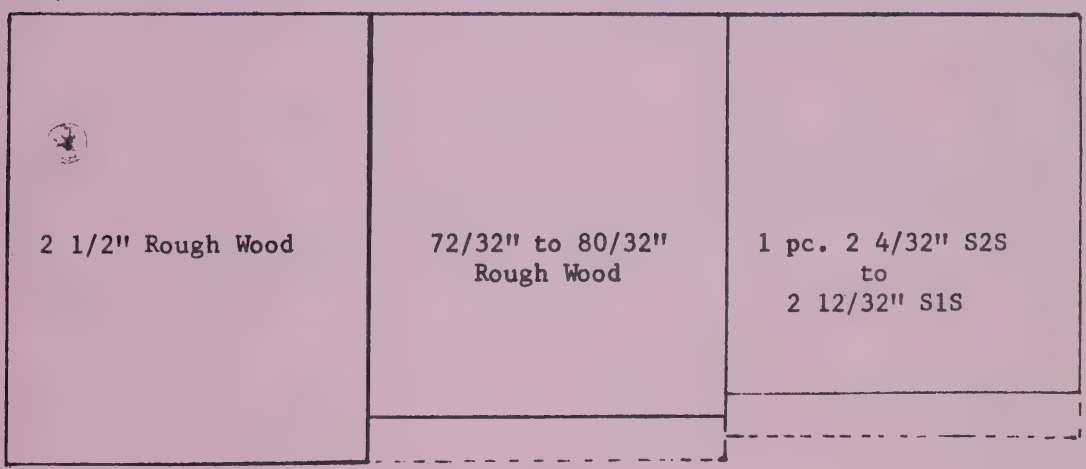
* Refer to stipulation Sub-section 19.4.8.3, 1 (a) & (b).

Nominal size and basis for dues not including tolerance for drying.	Actual minimum rough wood required.	Finished product.

9/4" Stock



10/4" Stock



11/4" Stock

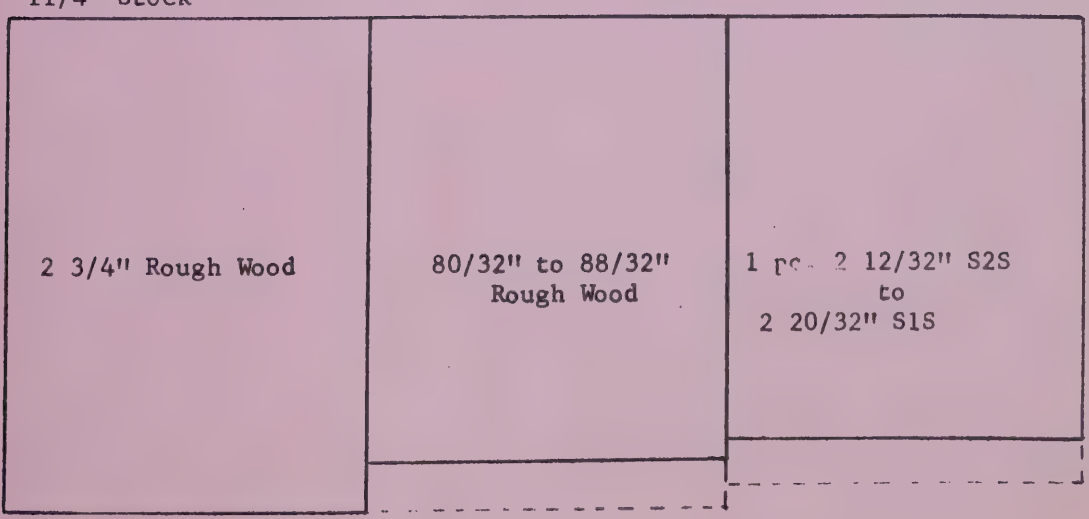


Figure 6 (a, b & c)

Cont'd. .....
Figure 6 A

Nominal size and basis for dues not including tolerance for drying.	Actual minimum rough wood required.	Finished product.

12/4 Stock

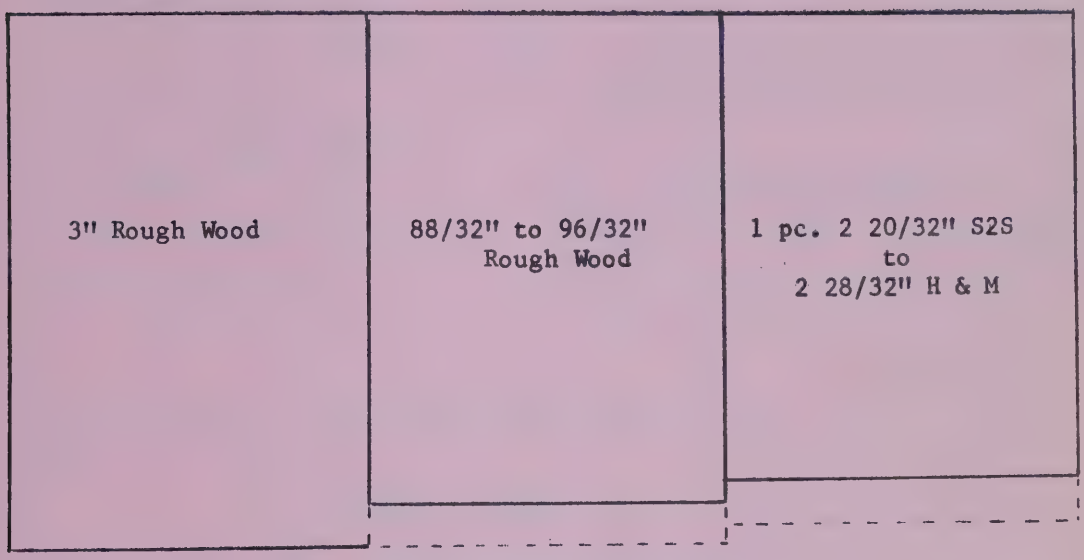


Figure 6 A (d)

19.4.8.6 STANDARD WIDTHS AND BASIS FOR TIMBER DUES - Dimension Lumber. Only width sizes are to scale.

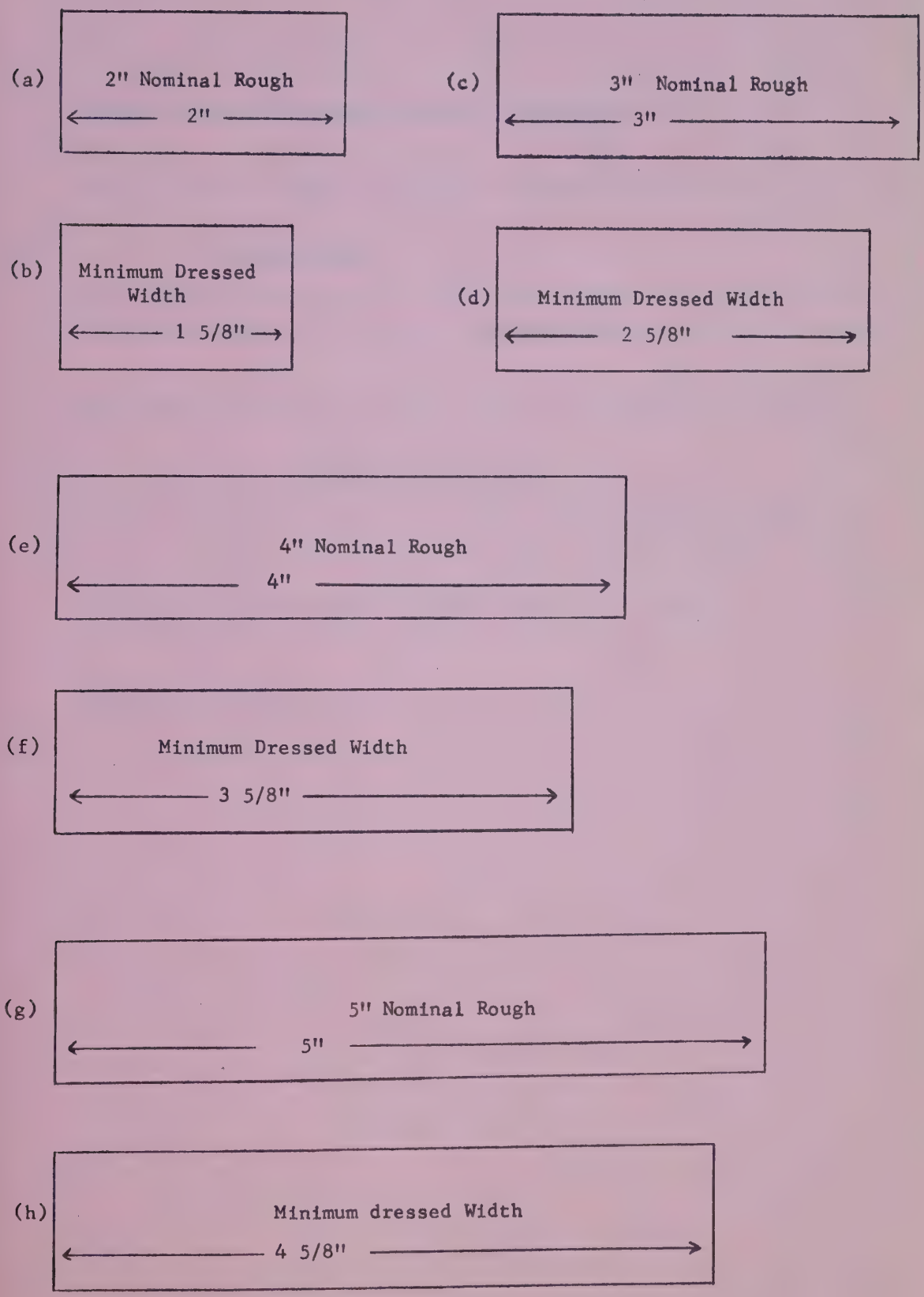
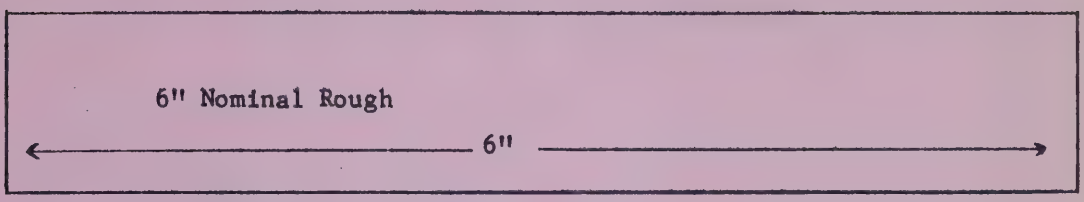


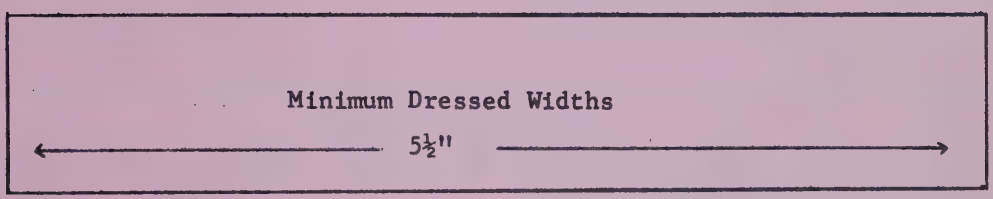
Figure 7, (a, b, c, d, e, f, g and h)

STANDARD WIDTHS AND BASIS FOR DUES - Dimension.

(a)



(b)



6" and wider, 1/2" scant of nominal width on all widths.

Figure 8, (a and b)

Standard Widths and Basis for Dues of Lumber worked to a Pattern.

The overall finished width is usually 1/2" scant of nominal width.

An illustration is as follows:

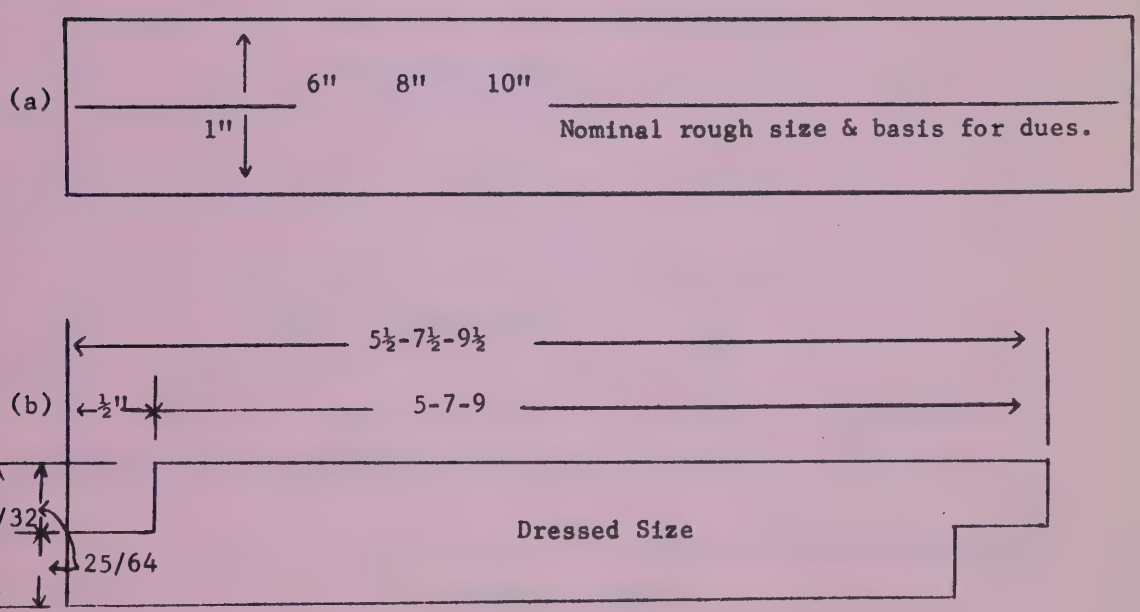
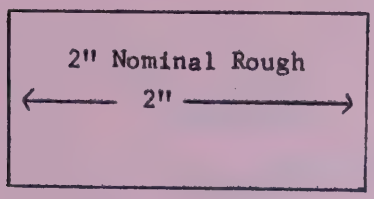


Figure 9, (a and b)

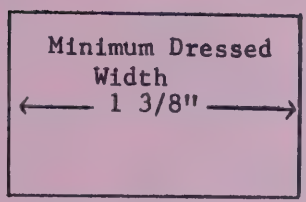
Standard Widths and Basis for Dues - boards common

Only width sizes are to scale - the nominal size is the basis for dues.

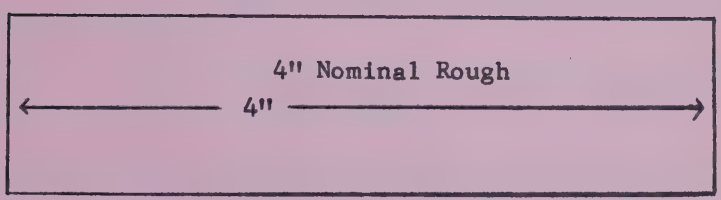
(a)



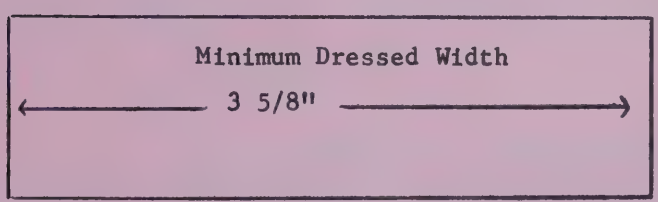
(b)



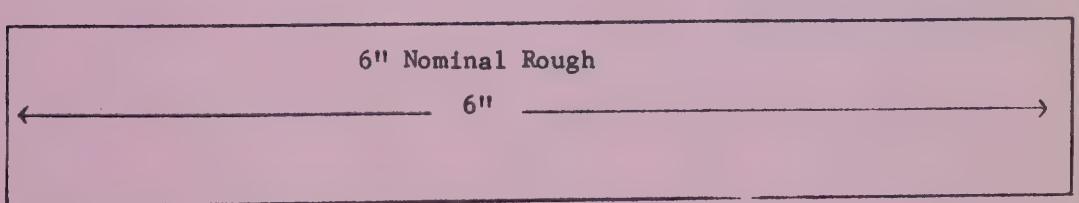
(c)



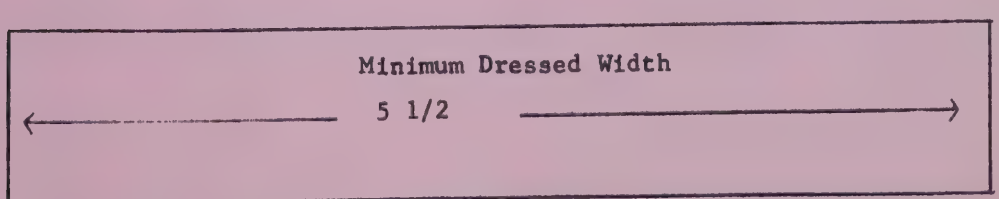
(d)



(e)



(f)



6" and wider, is usually ½" scant of nominal width.

(For further information on specific width sizes of other board stock refer to the grading rules publication employed by the Alberta Forest Products Association)

Figure 10 (a, b, c, d, e & f)

19.4.9 TIMBER DUES

Dues on lumber are usually paid to the Government at the contract rate per thousand F.B.M. either on scale or sale unless otherwise provided for.

19.5.8 LATH

Nominal measurements of lath are 1 1/2 inches wide, 3/8 of an inch thick and 32 inches or 48 inches long.

No. 1 Lath shall be not more than 1/8 of an inch scant of the nominal width nor 1/16 of an inch scant of nominal thickness.

No. 2 Lath may not be over 1/4" scant in width and must be at least 1/4" thick.

Lath shall be not less than 31 3/4 inches or 47 3/4 inches long nor longer than nominal length.

Lath are put in bundles of 50 pieces to the bundle and are sold by the piece or bundle.

Green or dry and regardless of grade or size the dues are per thousand pieces.

19.6.1 RAILWAY TIES

Ties are manufactured and graded according to each railway's specifications. Dues on ties are the same regardless of grade, sawed or hewed green or dry. Refer to the following tabulations and sketches.

RAILWAY SPECIFICATIONS FOR TRACK TIES

(8 feet long squared ends)

(All thickness and width measurements are shown below in inches)

GRADE	SAWED OR HEWED	KIND OF WOOD	C.N.R. Maximum	C.N.R. Minimum	C.P.R. Maximum	C.P.R. Minimum	N.A.R. Maximum	N.A.R. Minimum	AVERAGE Maximum	AVERAGE Minimum	EST.AV. F.B.M.
1	Top, Bottom and sides	Softwood	7 1/2x9 1/2*	7x9	8x10	7x9	7x9	7x9	71/2x91/2	7x9	42
1A	Top and bottom only (flatted)	Softwood	71/2x10*	7x7	8x10	7x7	7x9*	7x7	71/2x91/2	7x7	32 2/3
2	Top, Bottom and sides	Softwood	61/2x81/2*	6x8	7x9	6x8	6x8	6x8	61/2x81/2	6x8	32
2A	Top and bottom only (flatted)	Softwood	61/2x10*	6x6	7x10*	6x6	6x9*	6x6	61/2x91/2	6x6	24
3	Top, Bottom and sides	Softwood	61/2x81/2	6x8	7x8**	6x7**	-	-	7x9	6x8	32
3A	Top and bottom only (flatted)	Softwood	61/2x9* Est.	6x5	-	-	-	-	61/2x9	6x5	20

** hardwood only * nearest average - For specific size and tolerance refer to diagrams and specifications of each company - Section 19.6.

ACCEPTABLE KINDS OF WOOD

Alberta Softwoods	Alberta Hardwoods
Lodgepole Pine	Birch
Jackpine	
Douglas Fir	
Tamarack (Larch)	

Notes:

1. In addition to the above and diagram specifications, the railway companies have quality specifications for example (1) timber species (2) live green timber (3) decay and rot free (4) free from unsound knots, shakes, bark seams and worm holes, etc. (5) straight and parallel (6) clean peeled.
2. Acceptable length track ties: CNR 8'-8'1"; CPR 8'; NAR 8' $\pm$ 1/2".
3. Grade specifications of each company - maximum and minimum may vary from that of the others.
4. Ties, (AFS converting factor-circular T19) railway, all sizes and grades 8' in length 33 f.b.m. per tie. (For tie clearance purposes).

19.6.3 CANADIAN NATIONAL RAILWAY
TRACK TIE STANDARDS Rev. August 9, 1965

Kind of Wood and Manufacture

5. Softwood ties shall be of lodgepole pine, jack pine, princess pine or Douglas fir as specified. Square sawn Douglas fir ties must show heartwood on all four sides.

6. (a) All ties shall be made from sound, live, straight timber and shall be free from decay, rot, unsound knots, shakes, bark seams, worm holes and all other imperfections that would impair the strength or durability of the tie.

(b) A tie is considered straight when:

1. A straight line along the top from the middle of one end to the middle of the other end is everywhere more than 3 inches from either side of the body of the tie for Grades (Size) 1,2,1A and 2A, and 2 inches in the case of Grades (Size) 3 and 3A.

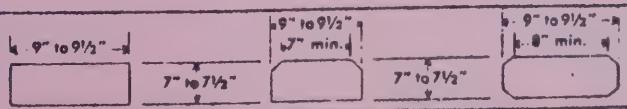
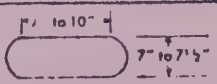
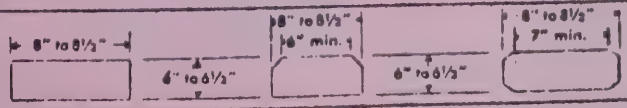
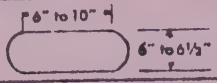
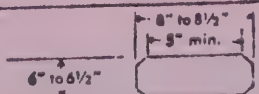
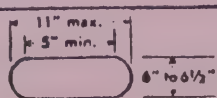
2. A straight line along the side from the middle of one end to the middle of the other end is everywhere more than 2½ inches from the top and bottom faces of the body of all ties.

7. Ties, other than Douglas fir, manufactured by halving or quartering large logs and which have the pith exposed will not be accepted.

8. All ties shall be sawn with the top and bottom faces parallel and the ends sawn square.

9. All ties shall be clean peeled. Ties will be considered clean peeled if no strips of inner bark wider than 1 inch or longer than 10 inches are left and there must be spaces of not less than 1 inch between such strips.

10. Unless otherwise stated all ties shall be 8 feet long with a tolerance of plus 1 inch. Dimensions shown on the table hereunder apply to sections of the tie between 20 inches and 40 inches from the middle of the tie. Wane on any one edge in the above mentioned areas shall not exceed 1½ inches for Grades (Size) 1,2 and 3.

GRADE	SAWED TOP BOTTOM & SIDES	SAWED TOP & BOTTOM ONLY
1		
1A		
2		
2A		
3		
3A		

NOTE: THE above numbering and diagrams are as designated in the C.N.R. Specifications.

19.6.4 CANADIAN PACIFIC RAILWAY
TRACK TIE STANDARDS Rev. January 3, 1955

*3. Hardwood ties shall be Beech, Maple, Ash, Oak or Birch, as specified.

*4. Softwood ties shall be of Hemlock, Ponderosa or Lodgepole Pine, Douglas Fir, Larch (Tamarac) as specified.

*5. All ties shall be made from sound, live straight timber and shall be entirely free from decay, rot, unsound knots, shakes, barkseams, wormholes, large seasoning checks, and all other imperfections that would impair the strength or durability of the tie. No ties manufactured by quartering or halving large logs and which have the heart exposed will be accepted. All ties with the heart visible, must have the heart well boxed.

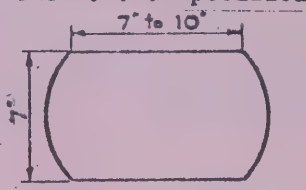
*6. All ties must be sawn or hewn smooth, free from score hacks, with top and bottom faces straight and parallel. No hewn Hardwood ties will be accepted. All ties shall be clean peeled.

*7. Cross ties must be of the dimensions shown in the following sketches, eight feet long with ends sawn square. Face measurements shall be taken at the narrowest point on either face. Thicknesses shown are minimum. Ties will be accepted which are manufactured up to one inch greater in thickness and, if squared, up to one inch greater in width than specified:

* the above numbering is as designated in the C.P.R. Specifications.

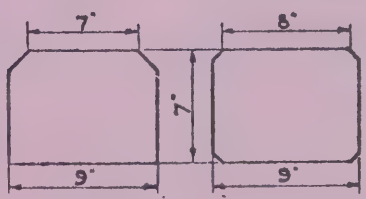
SOFTWOOD TIES

No. 1 flatted ties shall be seven inches thick with seven to ten inches face.



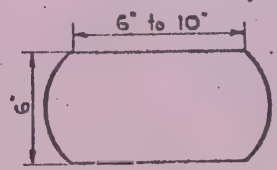
No. 1 FLATTED

No. 1 squared ties shall be seven inches thick and nine inches wide; may have 1" of wane on one or both corners of one side only, or 2" of wane on four corners with full eight inches face.



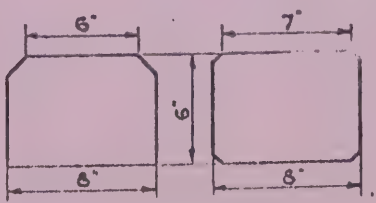
No. 1 SQUARED

No. 2 flatted ties shall be six inches thick with six to ten inches face.



No. 2 FLATTED

No. 2 squared ties shall be six inches thick and eight inches wide; may have 1" of wane on one or both corners of one side only, or 2" of wane on four corners with full seven inches face.



No. 2 SQUARED

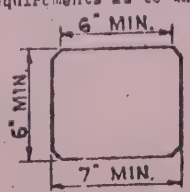
HARDWOOD TIES

All hardwood ties must be squared.

No. 1 squared ties shall be of the same dimensions as No. 1 squared softwood ties and subject to the same requirements as to wane and face.

No. 2 squared ties shall be of the same dimensions as No. 2 squared softwood ties and subject to the same requirements as to wane and face.

No. 3 squared ties must be not less than six inches thick and seven inches wide with minimum face measurement of six inches.



No. 3 HARDWOOD

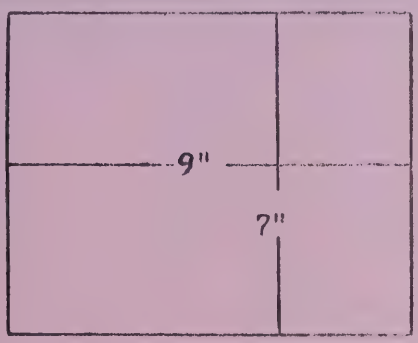
19.6.5

NORTHERN ALBERTA RAILWAY
TRACK TIE STANDARDS

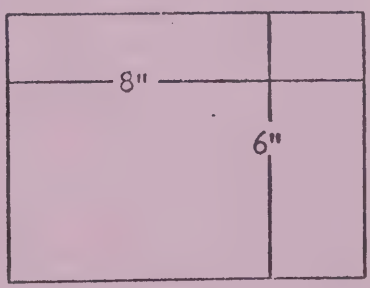
Kinds of Wood and Manufacture

Track Ties

5. All ties shall be cut from straight, young, live, sound timber of Tamarac, Jackpine, Lodgepole Pine, Fir, Cedar or such other kinds of wood as shall be authorized by the purchase order. The ties shall be straight throughout their length. They shall in all cases have square sawn ends and shall be sawn eight feet long, and shall not vary in length more than one-half inch either way, and sawn or hewn on two (2) sides truly parallel throughout to seven (7) inches thick for number one ties and six (6) inches thick for number two ties; and the sawn or hewn faces shall not be less than seven (7) inches for number one ties, nor less than six (6) inches for number two ties and not more than eleven (11) inches wide; they shall be sawn or hewn out of wind, and be free from score-hacks, and all other defects that would impair their strength and usefulness; and the width of the faces shall not vary more than one inch throughout the length of any one tie. No. 1 Sawn Square Ties shall be seven (7) inches by nine (9) inches by eight (8) feet long; No. 2 Sawn Square Ties shall be six (6) inches by eight (8) inches by eight (8) feet long. If sawn from large timber thay must be cut through the centre of the log. No. 1 ties shall not be in excess of fifty per cent (50%) of the total number of ties accepted, nor cull ties, if accepted, in excess of five per cent (5%) of the total number of No. 1 and No. 2 ties accepted. All ties shall be peeled and limbs and knots to be dressed off smoothly.



No. 1 Squared



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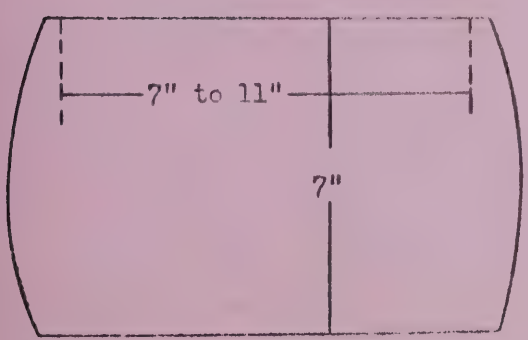
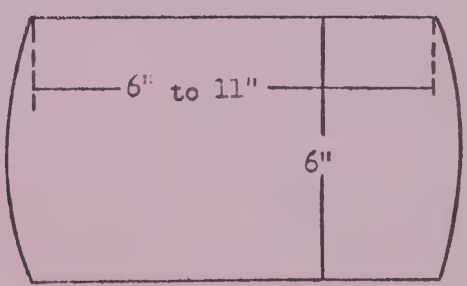


No. 1 Flatted



No. 2 Flatted

19.6.6 SWITCH TIES - DIMENSION

N. A. Railways

Switch ties must conform to the same specifications as for track ties, except as to length which is twenty-four (24) feet.

C.N. Railways

Switch ties are to be made from sound, live, straight timber and be free of decay, rot, unsound knots, shakes, bark seams, worm holes, and all imperfections that would impair the strength or durability of the switch tie. All switch ties must be sawn with the top and bottom faces parallel and the ends sawn square; 7" to 7 1/2" thick by 9" to 9 1/2" wide nominal size, and have a minimum of 8" face both top and bottom throughout that section between 12 inches from each end of the tie.

Switch ties one inch shorter and two inches longer than specified are accepted. Switch ties may be ordered by complete sets, as specified (see C.N.R. Table S3W-1.3 following) or by number of ties of stated lengths. When ordered by sets, the ties in each set ordered must be of the specific length and quantity as designated (refer table) by set number.

NUMBER OF TIES OF EACH LENGTH, REQUIRED PER SET

Turnout No.		No. 5	No. 7	No. 8 11'0" SW	No. 8 16'6" SW	No. 9	No. 10	No. 12	No. 16	No. 20	No. 20 39'0" Curved SW	No. 8 3'6" Gauge	No. 9 3'6" Gauge	No. 10 3'6" Gauge
Plan R11C		31.1	39.1	40.1	40.2	41.1	42.1	44.1	46.1	48.1	48.2	47.1	32.1	43.1
Length of Ties Feet	Inches													
7	6											12	9	12
8	0											6	3	6
8	6											3	3	4
9	0	14	14	15	16	17	19	22	31	33	29	3	3	3
9	6	3	3	4	5	5	6	6	10	10	14	2	3	3
10	0	3	3	3	4	3	4	5	7	9	11	3	2	3
10	6	2	3	3	3	3	4	5	7	8	9	2	3	3
11	0	2	2	3	3	3	3	5	6	7	7	3	2	4
11	6	2	3	3	3	3	3	4	6	6	6	2	3	3
12	0	1	2	2	3	3	3	3	5	6	6	2	2	3
12	6	2	2	2	2	3	3	4	5	6	5	3	2	2
13	0	2	2	2	2	3	3	4	4	6	6	2	2	3
13	6	1	2	3	3	3	3	4	5	6	6	2		3
14	0	2	2	2	2	2	3	3	5	6	6	1		2
14	6	1	2	2	2	3	3	3	5	6	8			
15	0	2	3	3	3	3	3	4	4	6	8	2	2	2
15	6	1	2	2	2	2	3	3	4	6	8			
16	0	3	3	4	4	5	5	5	6	8	2			
Total No. Pcs.		41	48	53	57	61	68	80	110	129	131	48	39	56
Total Lin.Ft.		463	555.5	614.5	655	710	787.5	922.5	1255	1500	1514	475	385.5	566
Total F.B.M.		2431	2916	3226	3439	3728	4134	4843	6589	7875	7949	2494	2024	2972

19.7.1 MINE TIES

Mine ties are manufactured from both spruce or pine and usually have a 5" face or less. There is a different rate of dues depending on whether they are green or dry. Some mines may require different sizes or grades depending on the requirement.

19.8 POLES PILING POSTS ROUND TIMBER

19.8.1 Timber dues

Currently dues are assessed on a piece basis by top diameter and length, up to a top diameter of ten inches. Any piece with a top diameter over ten inches inside bark shall be calculated in feet board measure or cubic feet as authorized by the Forest Management Regulations.

All diameters are based on measurements inside bark at small end. Refer to the General Schedule of Dues, Piece Rate Table for Green Round Timbers.

In due course a table of cubic content per piece by top diameter and length will be instituted on which basis to convert pieces to cubic measure for dues assessment.

When such cubic content table is instituted the General Schedule of Dues will be revised to include a cubic measure rate.

19.8.2 PINE POLES AND REINFORCING STUBS

The Canadian Standards Assocation have adopted the following jack and lodgepole pine pole strength classes:

Class of Pole	Approx. Breaking Load
1	4500 pounds
2	3700 pounds
3	3000 pounds
4	2400 pounds
5	1900 pounds
6	1500 pounds
7	1200 pounds
8	960 pounds
9)	(for butt requirements
10)	refer to Clause 5.2 under Dimension)

Four classes and five lengths of reinforcing stub classes have been established as follows:

(a) Class of Stub	Classes of Associated Poles
Z	1 and 2
Y	3 and 4
X	5 and 6
W	7, 8, 9 and 10

(b) Length of Stub in Feet	Length of Associated Poles in Feet
10	20, 25 and 30
11	35 and 40
13	45 and 50
15 1/2	55
19 1/2	60, 65 and 70

It is recognized that ordinarily a pole will be stub reinforced only after it has served a substantial part of its physical life. In practice, a stub is selected with a circumference 6 feet from the butt approximately 2 inches less than the circumference at 6 feet from the butt of a new replacing pole adequate to support the load.

DIMENSIONS

1. LENGTH shall be measured between the extreme ends of the pole. Poles less than 50' shall not be longer or shorter than 3 inches of the nominal length.

3. Circumference is measured at 6 feet from the butt and at the top for each length and class of pole as listed in the following Tables 3 and 4. (Circumference is converted to diameter by dividing by 3.1416).

(a) The circumference at 6 feet from the butt of poles Classes 1 to 8, inclusive shall not be more than 7 inches larger than the specified minimum.

19.8.2.3

TABLE 3

DIMENSIONS OF JACK PINE POLES
(Fibre Stress 6,400 psi) *

Class		1	2	3	4	5	6	7	8	9	10
Minimum Circumference at Top, Inches		27	25	23	21	19	17	15	15	15	12
Length of Pole, Feet	*Ground Line Distance From Butt, Feet	Minimum Circumference at 6 Feet From Butt, Inches									
16	3½					22.0	20.5	19.0	17.5	For Butt Requirements see Clause 5.2	For Butt Requirements see Clause 5.2
18	3½			27.5	25.5	23.5	21.5	20.0	18.5		
20	4	33.0	31.0	29.0	26.5	24.5	23.0	21.0	19.5		
22	4	34.5	32.5	30.0	28.0	26.0	24.0	22.0	20.5		
25	5	36.0	34.0	31.5	29.5	27.0	25.0	23.0	21.5		.....
30	5½	39.0	36.5	34.0	32.0	29.5	27.0	25.0	23.5	.....	
35	6	42.0	39.0	36.5	34.0	31.5	29.0	27.0	25.0		
40	6	44.0	41.5	38.5	36.0	33.0	30.5	28.5	—		
45	6½	46.0	43.5	40.5	37.5	35.0	32.0	30.0	—		
50	7	48.0	45.0	42.0	39.0	36.5	33.5	31.0	—		
55	7½	50.0	47.0	43.5	40.5	37.5	35.0	—	—		
60	8	51.5	48.5	45.0	42.0	39.0	36.0	—	—		
65	8½	53.5	50.0	46.5	43.5	40.0	—	—	—		
70	9	55.0	51.5	48.0	44.5	41.5	—	—	—		

NOTES: *Dotted lines indicate length limits.*

**The figures in this column were used in determining the required circumferences at ground line and should be used whenever a definition of ground line is necessary.*

*psi pounds per square inch

TABLE 4

DIMENSIONS OF LODGEPOLE PINE POLES
(Fibre Stress 6,600 psi)

Class		1	2	3	4	5	6	7	8	9	10
Minimum Circumference at Top, Inches		27	25	23	21	19	17	15	15	15	12
Length of Pole, Feet	*Ground Line Distance From Butt, Feet	Minimum Circumference at 6 Feet From Butt, Inches									
16	3½					22.0	20.5	19.0	17.5	For Butt Requirements see Clause 5.2	For Butt Requirements see Clause 5.2
18	3½			27.5	25.5	23.5	21.5	20.0	18.5		
20	4	32.5	30.5	28.5	26.5	24.5	22.5	21.0	19.5		
22	4	34.0	32.0	30.0	27.5	25.5	23.5	22.0	20.5		
25	5	36.0	33.5	31.0	29.0	27.0	25.0	23.0	21.5		.....
30	5½	39.0	36.5	34.0	31.5	29.0	27.0	25.0	23.0	.....	
35	6	41.5	38.5	36.0	33.5	31.0	28.5	26.5	25.0		
40	6	44.0	41.0	38.0	35.5	33.0	30.5	28.0	—		
45	6½	46.0	43.0	40.0	37.0	34.5	32.0	29.5	—		
50	7	48.0	45.0	42.0	39.0	36.0	33.5	31.0	—		
55	7½	49.5	46.5	43.5	40.5	37.5	34.5	—	—		
60	8	51.5	48.0	45.0	42.0	38.5	36.0	—	—		
65	8½	53.0	49.5	46.0	43.0	40.0	—	—	—		
70	9	54.5	51.0	47.5	44.5	41.0	—	—	—		

NOTES: *Dotted lines indicate length limits.*

**The figures in this column were used in determining the required circumferences at ground line and should be used whenever a definition of ground line is necessary.*

TABLE 6

DIMENSIONS OF JACK PINE REINFORCING STUBS
(Fibre Stress 6,400 psi)

Length of Stub	Minimum Circumference at 6 Feet From Butt			
	Inches			
Feet	Class Z	Class Y	Class X	Class W
10	37.0	32.0	27.5	23.0
11	42.0	36.5	31.0	26.5
13	46.0	40.0	34.5	29.0
15½	48.0	41.5	35.5	—
19½	53.0	46.0	39.5	—

TABLE 7

DIMENSIONS OF LODGEPOLE PINE REINFORCING STUBS
(Fibre Stress 6,600 psi)

Length of Stub	Minimum Circumference at 6 Feet From Butt			
	Inches			
Feet	Class Z	Class Y	Class X	Class W
10	37.0	32.0	27.0	23.0
11	42.0	36.0	31.0	26.0
13	46.0	40.0	34.0	29.0
15½	47.5	41.5	35.5	—
19½	52.5	45.5	39.0	—

(b) The circumference at 6 feet from the butt of poles Classes 9 and 10 shall be less than that shown for the corresponding circumference of Class 8 poles of the same length; and

2. The top dimensional requirement shall apply at a point corresponding to the minimum length permitted for the pole.

Note: The above tables and numbering are as set out in the C.S.A. Specifications 015.3 -- 1960.

19.8.2.4 SMALL ROUND TIMBER

Standard peeled seasoned fence post and barn pole sizes are as follows:

FENCE POSTS		BARN POLES	
Peeled Seasoned Sizes			
Top Diameter	Length	Top Diameter	Length
3"	6'	4"	12'
4	6	5	12
		6	12
4	7	4	14
5	7	5	14
6	7	6	14
5	8	4	16
6	8	5	16
7	8	6	16
5	10	4	18
6	10	5	18
7	10	6	18
8	10	4	20
		5	20
		6	20
		4	25
		5	25
		6	25

19.8.2.5 PILING

For Treatment and False Work

Standard dimension of piles accepted by the Bridge Branch of the Highways Department are as follows for pine and Douglas fir:

Length	Tip Diameter Inside Bark	Butt Diameter Inside Bark
up to 20'	9"	12"
over 20 and up to 40'	8"	12"
over 40 and up to 60'	7"	13"

A pile may be 1/2" smaller in either or both tip and butt diameters in one axis provided that the minimum circumferences be as follows:

For 7" diameters	21"
For 8" diameters	24"
For 9" diameters	27"
For 12" diameters	37"
For 13" diameters	40"

The maximum butt diameter must not exceed 16"

The minimum thickness of the sapwood shall be 1/2" as measured on the small end of the pile. No pile is rejected where the thickness of the sapwood falls below the 1/2" but not lower than 3/8" for a distance of six inches as measured around the circumference, provided it is of the minimum thickness around the balance of the circumference.

In addition to the foregoing quality specification is also rigid concerning peeling, knots, straightness, spiral grain, catfaces, shakes and checks and pitch streaks.

The above is an extract from the Department of Highways, Bridge Branch Specifications publication B-167-63.

Standard dimension of piles set out by the Canadian Pacific Railway Company are as follows:

> Piles shall be of approved varieties of Douglas Fir, Pine, Larch, Tamarack, Spruce or Cedar and shall be of the specific species ordered.
>
> Additional described requirements are set out under Physical Properties of the company's specifications.
>
> Individual piles may vary from the length specified as much as ± 1 foot in piles of 40 feet or less and ± 2 feet in piles over 40 feet in length.

Length in feet	Diameter 3 feet from butt in inches		Diameter at tip in inches
	Minimum	Maximum	Minimum
Under 40	14	18	9
40 to 50	14	18	8
51 to 70	14	18	7
71 to 90	14	18	7
Over 90	14	18	6

The Northern Alberta Railway Company specifications indicate the following measurements:

Length in feet	Diameter I. S. B. 6' from butt		Top Diameter
	Minimum	Maximum	Minimum
Up to 40	14"	20"	9"
Over 40	14"	20"	8"

19.9 GRAIN DOORS

In Alberta several types of grain doors are in use and at times these may be manufactured in the province. If an operator of a Timber Licence or Special Timber Permit manufactures grain doors, the foot board measure content of material in each door is required to determine the quantity of lumber so utilized.

The following are solid type grain doors together with the f.b.m. of lumber required to construct each door:

Railway	Type	Dimension	F.B.M.
C.P.R.	MK 1	84" x 16 1/2"	18 3/4
C.P.R.	MK 3	108" x 16 1/2"	23 3/4
C.N.R.	F	84" x 30"	36 1/3
C.N.R.	E	84" x 30"	37
C.N.R.		84" x 18"	21 1/2
C.N.R.		84" x 10"	13
N.A.R.		84" x 18 1/2"	21 1/3

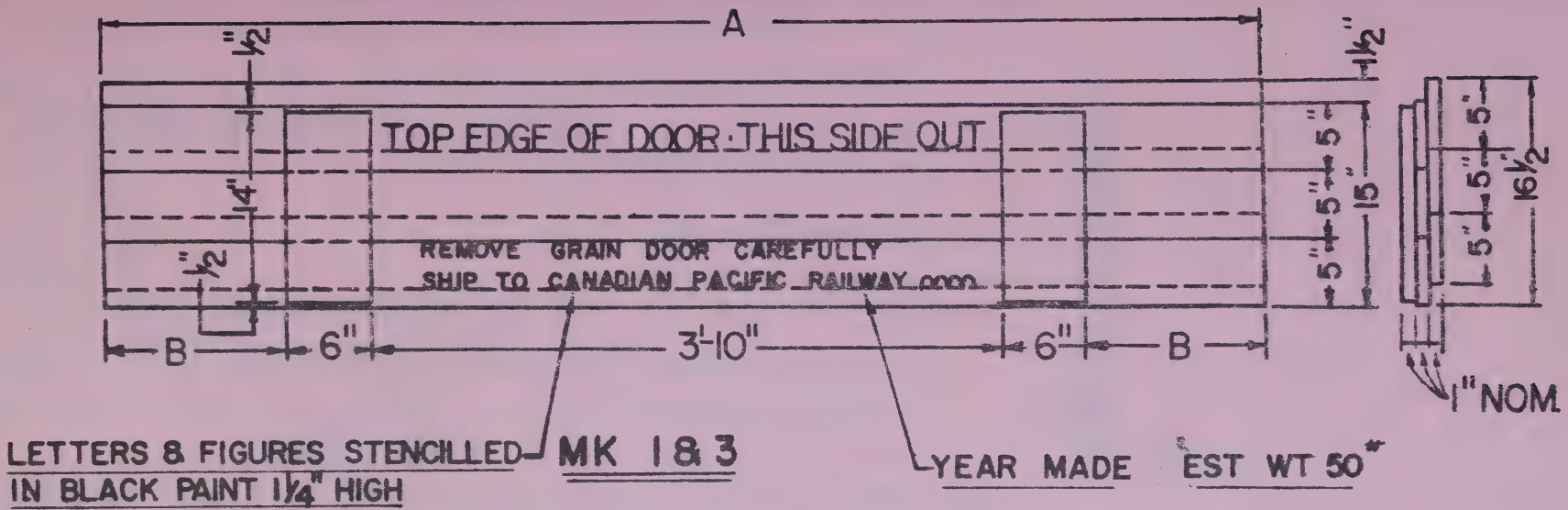
The following pertains to panel type doors:

C.N.R.		19" x 84"	15 1/4
C.P.R.	MK 2	21 1/2" x 84"	19 1/3
C.P.R.	MK 4	21 1/2" x 108"	24 3/4

The Canadian Pacific Railways advised recently that their grain door requirements are now largely purchased in a metal re-inforced paper doors.

The Canadian National Railways requirements are largely purchased in the type E doors. The type E door is apparently preferred to that of the panel type and the type F.

Diagrams of various grain doors of the railway companies that are currently employed are as follows:



	C	B	A	MK*	CAR DOOR OPENING
	—	13"	7'-0"	1	6'-0"
	6'-4"	13"	7'-0"	2	6'-0"
	—	2'-1"	9'-0"	3	8'-0"
	8'-4"	2'-1"	9'-0"	4	8'-0"

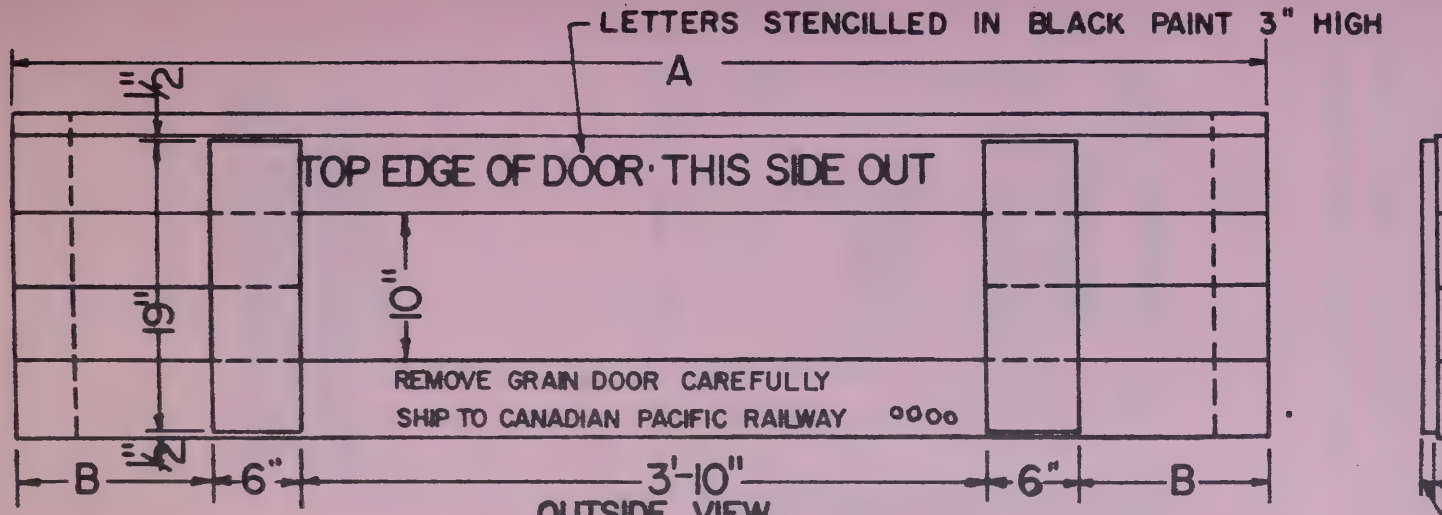
Diagram of MK 2 & 4 doors shown on overleaf.

MATERIAL - Common selected green lumber of Pine Tamarac, Hemlock, Spruce or Fir.

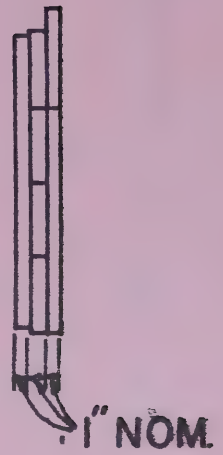
STYLE-1 - Dressed hit and miss one side, one edge, to not less than 1" thickness. Random widths may be used providing 1 1/2" min. lap is maintained.

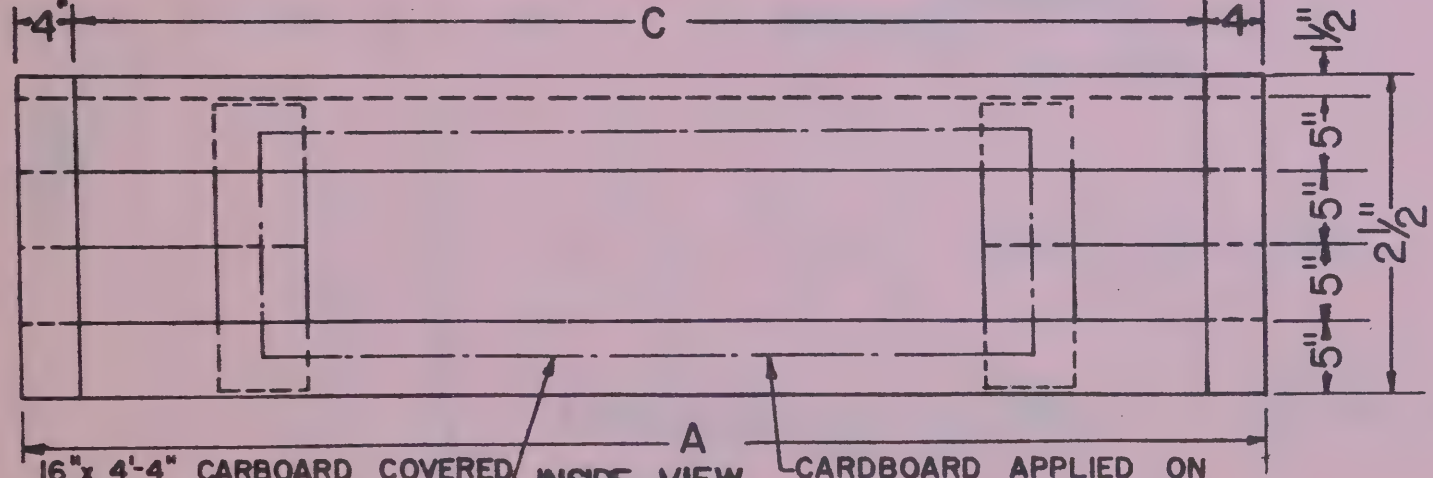
STYLE-2 - Dressed hit and miss one side, one edge to not less than 1" thickness & full width.

Nails to be #11 x 2 1/2" clinch point.
Nails to be #11 x 3 1/2" clinch point for battens.



OUTSIDE VIEW





INSIDE VIEW

MK 2 & 4

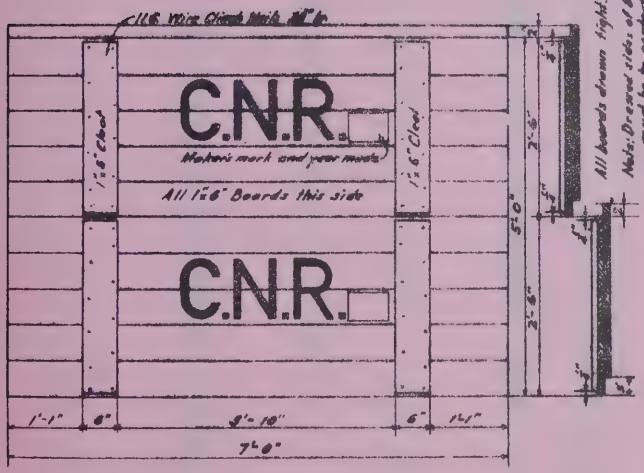
EST. WT. 50#

	C	B	A	MK*	CAR DOOR OPENING
	—	13	7'-0"	1	6'-0"
	6'-4"	13"	7'-0"	2	6'-0"
	—	2'-1"	9'-0"	3	8'-0"
	8'-4"	2'-1"	9'-0"	4	8'-0"

19-9-3

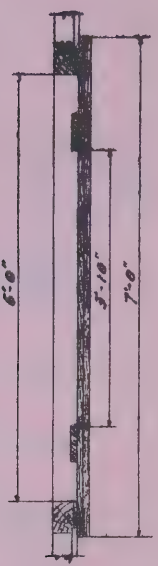
CANADIAN NATIONAL RAILWAYS
TYPE E
SOLID TYPE GRAIN DOOR

ELEVATION FROM INSIDE OF CAR

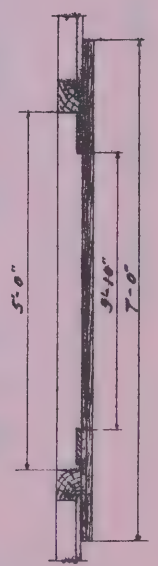


ELEVATION FROM OUTSIDE OF CAR

RAILWAY CAR DOOR OPENING



DOOR 6'0" WIDE



DOOR 5'0" WIDE

NOTES:

- DOORS TO BE MADE ONLY OF PINE OR SPRUCE SIDES FULL 7/8" WHEN DRESSED.
- NO DOOR WILL BE ACCEPTED IF LESS THAN 29½"
- LUMBER MUST BE OF GOOD QUALITY, SOUND, WELL SEASONED AND FREE FROM DRY ROT, KNOTS, RAGGED EDGES, SAP STAINS, CRACKS, LARGE LOOSE KNOTS OR COARSE GRAIN, OR OTHER DEFECTS WHICH MAY IMPAIR ITS STRENGTH OR DURABILITY.
- OUTSIDE OF DOORS TO BE STENCILLED WITH LETTERS 'C.N.R.' 10" IN HEIGHT.
- NO TAR PAPER BOARDS, MATTING OR CLOTH MUST BE USED.
- EACH DOOR TO HAVE MAKERS NAME OR MARK AND YEAR MARK.
- ALL NAILS TO BE 2 1/2" NO. 11 GA. WIRE CLINCH NAILS, SAMPLES OF WHICH MAY BE PROCURED FROM PURCHASING AGENT. PARTICULAR CARE MUST BE TAKEN THAT NO OTHER NAIL IS USED.

MATERIALS FOR ONE SECTION

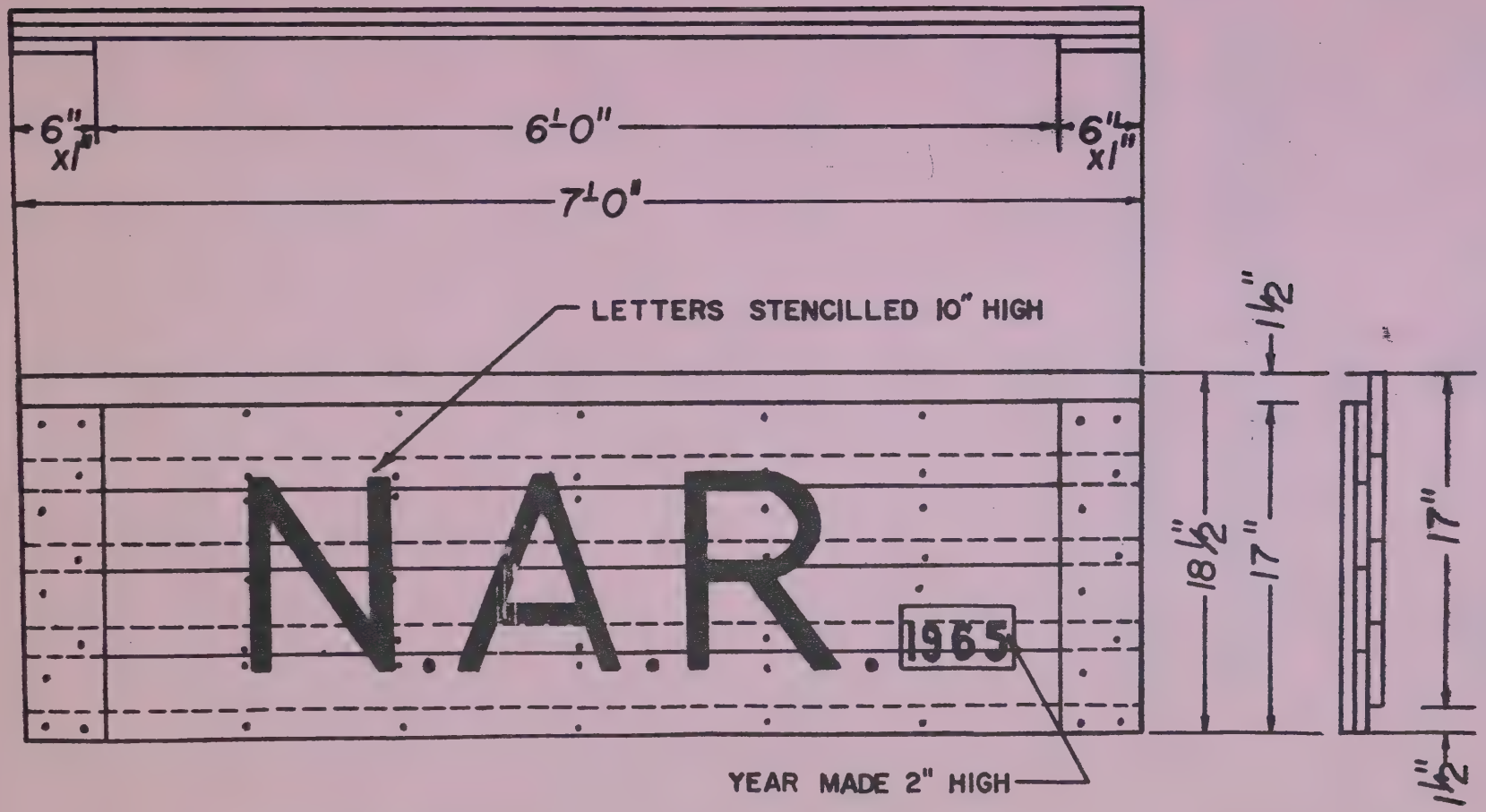
9 PCS. 1" x 6" x 7'-0" ---- 51¼
1 " 1" x 5" x 7'-0" ---- 5
2 " 1" x 6" x 3'-0½" ---- 2½
56 NAILS

57.0

Type 'E' Revised July 19th. 1920.

Approved July 19th. 1920
Assistant General Manager

19.9.4 NORTHERN ALBERTA RAILWAY * Solid Type Grain Door



NOTE:
Doors may be made of Pine, Spruce, Hemlock, Tamarac or Fir. Lumber to be 1" rough dry and free from holes and checks. Boards to be not less than 4" wide.

Joints of inside and outside boards to be lapped not less than 1 ½", nails to be # 11. 2 ½" clinch point. Nails for battens to be 3 ½" coated.

NOTE: Traced from C.P.R. dwg. P-[illegible]-1935-F, dtd. 8, 1947 Revised Dec. 5, 1965

19.10 COAL DOORS

The coal doors required by the railway companies together with the f.b.m. content are as follows:

Solid or Closed Type

Railway	Dimension	F.B.M.
C.N.R.	7' x 24"	15 1/3
C.P.R.	7' x 24"	16

Open Type

C.N.R.	7' x 24"	13

The Canadian Pacific Railways Company coal doors are manufactured from rough one inch boards held together with a batten at either end to form a door two foot by seven foot, capable of holding any size of coal.

Diagrams and description of material requirements of the Canadian National Railways Company open and tight or closed type doors are as follows:

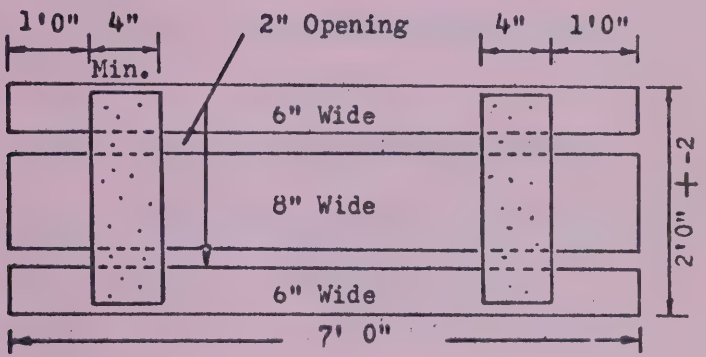
CANADIAN NATIONAL RAILWAYS

Specification for Coal Doors - Mountain & Prairie Regions
as revised December 3rd, 1965

OPEN DOORS

FOR LUMP COAL: Not more than two inch spaces allowed between boards. Material totalling at least twenty inches in width must be used in making the specified width of twenty-four inches, viz:- (nominal width).
Two pieces six inches wide and one piece eight inches wide, (see cut below) or:-
One piece twelve inches wide and one piece ten inches wide.

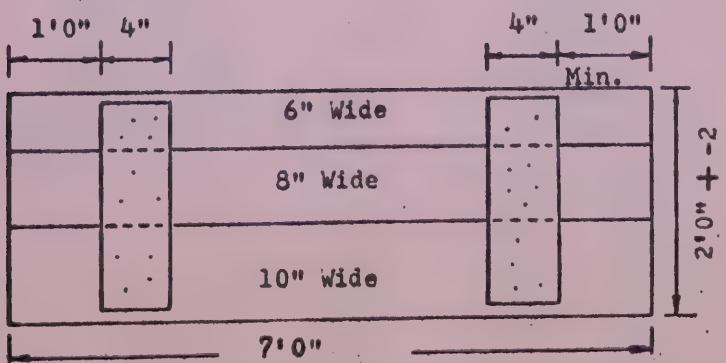
OPEN DOOR: -



TIGHT OR CLOSED DOORS

FOR STEAM COAL: Material totalling a full twenty-four inches in width (nominal width) must be used in making a tight door, viz: -
Six pieces four inches wide
or
Four pieces six inches wide
or
Three pieces eight inches wide
or
Two pieces twelve inches wide
or
Combination of sizes that will total twenty-four inches in width or height. (see cut below).

TIGHT OR CLOSED DOOR: -



19.11 Miscellaneous

19.11.1 Approximate Average Weights of Alberta Wood

The weight of timber varies by species, size, age, site and growth development (seasonal variation, amount of sapwood, heartwood and cull). The following conditions also result in weight variance:

1. Trees, Logs or Round Timbers

   - Green, dry or partially seasoned. (Freshly felled, fire killed or decked for a period).

2. Lumber

   (a) Manufactured thickness - sawn scant, standard or heavy.

   (b) Stage of manufacture - rough or dressed.

   (c) Moisture content - green, half dry, air dry or kiln dry.

Where the material is sawn heavy to size, the volume thereof converted to weight will vary considerably, if the volume is based on the nominal size instead of the actual thickness.

19.11.1.1 Approximate Lumber Weight in Pounds per 1,000 feet Board Measure:

	Pine			Spruce		
	Dry	Half Dry	Green	Dry	Half Dry	Green
Boards S1S	2000	2450	2900	1800	2100	2400
Lumber, rough	2400	2800	3500	2000	2300	3000

19.11.1.2 Approximate Pulpwood Weight in Pounds per Cord (coniferous):

	Pine	Spruce
Oven Dry	2255	1740
Air Dry (12% Moisture Content)	2350	2000
Green, rough	4135	3920
Tree Lengths - Average	5000	

19.11.1.3 Approximate Peeler Bolts Weight in Pounds per 1,000 feet Board Measure:

Green Balsam Poplar	8500
Green Aspen	7500
Green Pine	7500
Green Spruce	6715
Half Tree Lengths (Sw)	9000
Half Tree Lengths (Pl)	9600

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

FOREST MANAGEMENT

TREE MARKING INSTRUCTIONS

CHAPTER 20

- Revised - February 1961

FOREST MANAGEMENT
CHAPTER 20

TREE MARKING INSTRUCTIONS

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DEPARTMENT OF LANDS AND FORESTS
ALBERTA FOREST SERVICE

FOREST MANAGEMENT

CHAPTER 20

TREE MARKING INSTRUCTIONS

20.1 Introduction

Marking is generally aimed toward a two cut shelterwood system where the first cut provides better conditions for establishment and growth of regeneration as well as increased yield of the reserve stand. It is expected a second cut may be made after regeneration has been established.

For most trees the choice is obvious. Some trees are sound, clean, straight, tall, have a good crown and are vigorous; they are the wanted trees in the future stand. Others are defective, crowded and overmature or there may be other undesirable elements in the growing stock. In general, species composition, stand structure and quality will identify the trees that should be left to grow. Without any particular study, these trees are known to be the ones that will increase the total value of the forest. In addition to these there are borderline trees that are difficult to decide whether to leave or mark for cutting. In many stands there are so many trees that growth would be impaired if all were left. Marking rules cover many conditions with the supposition that practical application will result in the field. Discretion is necessary at all times in the practice of marking and the task shall be correlated with the utilization standards and market requirements at the time. Marking will be applied mainly to certain spruce stands rather than pine, therefore this presentation applies to the former species specifically and in general to the latter.

20.2 Objectives

The object of marking is to reduce the waste caused by decelerated growth due to the undesirable factors in growing conditions. Improve stand composition and character by removing trees of less desirable species, form and condition in the main canopy. Remove trees killed, injured or susceptible to damage through fire, insects, fungi or other harmful agencies for the purpose of utilizing merchantable material before it becomes worthless. Prevent the spread of insects and disease. Increase the rate of growth and the ultimate total production of the reserve stand. Provide suitable conditions for regeneration.

20.3 Selection of Trees to be Marked

Actual marking procedure must of necessity be governed by the character of the individual stand. It is possible, however, to outline a rule of stand improvement selection which is generally applicable, but which may be modified in detail to suit local conditions. It must be kept in mind that the second harvest may not take place for possibly 15 to 25 years.

The marking of a less desirable species such as balsam fir definitely encourages the utilization of same as well as improving stand conditions. In the interests of stand improvement, balsam fir of merchantable size should be marked for cutting in every possible instance.

In areas where definite proof of abnormal disease or insect damage is evident, the stand should be clear cut. In cases of doubt, however, the stand should first be given a normal marking and the timber examined during felling.. If the majority of the stems are then found to be infected, the balance of the stand should be marked for clear cutting. It is therefore imperative that continued contact with the cutting phase of operation be maintained. In general, it is not economically possible for an operator to send his cutters and extractors into a remarked area. Any remarking must be carried out at the time of cutting with the possible exception of a clear-cut by which means a higher volume per acre is removed. It is a requisite that no large openings in the canopy be created through marking otherwise serious blowdown may occur particularly on the wetter sites where trees are shallow rooted.

20.4 Marking Rules

1. Mark all defective trees for falling.
2. Mark overmature trees.
3. Mark larger trees.
4. Leave thrifty trees.
5. Uniformly spaced residual stand.
6. Mark sufficient volume.
7. Mark not more than 40% by volume of stand.

20.4.1 Discussion

20.4.1.1 Mark all Defective Trees for Falling

All defective trees should be felled and logged where the merchantable yield is one-half of the gross scale. Defective trees contribute little to the growth of the forest and occupy valuable growing space. If left standing they are liable to insect attack. Trees to be cut include those showing evidence of rot or insect attack, conk (conk is an indication of rot), woodpecker holes, pitch exudation, scaled bark, etc. Trees with excessive crook, excessive lean, forks or other weakening deformities should be removed. Where possible only thrifty trees with clean, smooth stems of good form should be left, i.e. one-third or more crown.

20.4.1.2 Mark Overmature Trees

The oldest trees in a stand should be marked as they generally are a poor risk as leave trees. Some of the characteristics of overmature trees are, rough appearance to bark, poor leader growth, rounded tops, poor crowns, low radial increment less than 0.4 inches per last ten rings.

20.4.1.3 Mark Larger Trees

Where there is a choice between two or more trees in the same classification, the larger trees should be chosen.

20.4.1.4 Leave Thrifty Trees

Growth of suppressed trees can be expected to increase in an evenly spaced residual stand, but greater growth will be obtained from those which are in a currently thrifty condition. Growth vigour is evidenced by length and width of live crown, position of tree in the crown canopy and by the general appearance of the trees.

20.4.1.5 Uniformly Spaced Reserve Stand

The object of marking is to leave a healthy, well-spaced stand. For best development of form and increment, spacing should be as uniform as possible.

20.4.1.6 Mark Sufficient Volume

The ratio of cut to leave may vary with the stand and with prevailing economic conditions in any locality. Removal of not less than 2,000 f.b.m. per acre is also to be considered as well as the accessibility of the area and the value of the trees in question. Scattered trees are better left as seed trees. The ruling of 40% removal of volume should be considered when marking and not exceeded. Frequent periodic sampling employing quarter acre rectangular plots in the area marked is required to check on the volume to be removed and volume removed.

20.4.1.7 Mark not more than 40% by Volume of Stand

The yield is estimated as a percentage of the total volume of all trees, 4" D.B.H. and up. At the present time, the percentage of the total stand that may be cut approximates 40% of the volume in a healthy stand.

20.5 "Do's" and "Don'ts" of Marking

20.5.1 "Do's" of Marking

Do mark trees adjacent to skid roads that were damaged during road building.

Do try to reserve those thrifty, healthy trees with good crowns.

Do give priority of marking to trees with abnormalties such as scars, broken tops, school marms, excessive sweep, leaners, etc., if economic to cut.

Do mark trees of doubtful merchantability and explain to operator.

Do mark heavier in draws, swamps or other places with poor drainage.

Do put butt marks as low as possible on the stem, preferably between collars where it can't be readily sluffed off.

Do mark both forks of a school marm.

Do leave wind breaks or mark very lightly in areas adjacent to clear-cut draws or swamps.

Do check volume removal frequently by plot sampling so as not to exceed 40%.

20.5.2 "Don'ts" of Marking

Do not mark too heavily (it is better to have a stand too lightly marked than one marked too heavily).

Do not mark over 40% of total volume to cut (unless instructed otherwise) since road clearings will take out at least another 10%.

Do not mark trees on which the timber sale boundary is located.

Do not mark trees that would be difficult to remove without damaging adjacent unmarked trees.

Do not mark isolated trees (if there is only one tree to mark in the immediate vicinity, then leave it.)

Do not lay out c.c. strips parallel to the prevailing winds.

Do not lay out c.c. strips against the contour (it may encourage erosion) i.e. up and down hill.

20.6 Equipment Required for Tree Marking

The following is a tentative list of equipment for a tree marking crew.

Tree Marking Instructions
Compass
Chain, trailer tape 2 1/2 chains
Increment borer
Photoholder
Stereoscope pocket
6 inch scale (10th, 20th)
Pencils - coloured and 2H
Protractor
Photographs 1320'
Dot template or areameter
Stationery
Tally sheets
Daily Scale Summary sheet
Tape menders
Axe marking A.F.S. or paint gun
Pulpwood tally card holder
Calipers
Rucksack
Volume table

20.7 Duties of the Marker and Axemen

The marking crew normally consists of one marker and two axemen.

20.7.1 Duties of the Marker

The marker directs the work of the crew and is responsible to the Forest Division in regards to all aspects of marking. He assists in the selection of the trees to be marked and records the tally on the tree tally card. He maintains close contact with the licensee or permittee and the Forest Division to correlate annual operating plans with marking plans. The marking pace shall be maintained ahead of the cutting pace to ensure an adequate reserve of marked trees for each crew of cutters.

The detailed type map 4" to 1 mile scale shall be employed as a progress map. Besides indicating probable merchantable types, topographic features and the berth boundary, marked and cut-over areas may readily be designated by means of hatching and cross-hatching respectively. Also depicit locations of mill-site, roads, clear cuts etc. The volume also could be recorded by areas or blocks.

At the completion of the day's field work, the map entry and conversion of the tally to a volume figure by means of the local volume table may be accomplished. The daily volume is entered on the Daily Tree Scale Summary Sheet with additional specified information. At the end of the month two copies are submitted to the Forest Division office with the duplicate being forwarded to head office.

Differences of opinion are bound to occur as a result of marking. These points may generally be settled between the marker and the operator and any that are not resolved by this means should then be referred to the Forest Division by the marker or operator. The Division shall promptly investigate and decide on same. The economics of the individual tree should be considered.

20.7.2 Duties of the Axemen

The axemen blaze the selected trees at D.B.H. and on the stump at a point not more than 6 inches above the ground and stamp A.F.S. clearly on the exposed inner wood. In the event that a paint spray gun is used for marking, the marks shall be placed in the same positions. The blaze should be placed so that it may be seen when marking the next strip. When marking trees growing on definite slopes the blaze generally should be on the down hill side (i.e. the direction of fall of the tree) to accommodate the cutters.

The axeman appraises the tree for defect and calls out the species, diameter and cull factor to the marker who shall repeat same for confirmation purposes and enter the reading on the tally sheet. As an axeman is oft times unable to see the defects in the higher position of the tree, the marker in inspecting crowns and tree form will take care that such trees are marked and tallied correctly.

20.8 Techniques and Field Procedures

20.8.1 Office

Where marking of a timber sale is recommended, the first step in initiating such marking is the preparation of field data. Such data is taken from

the cruise report and includes the following information:

1. Management Unit
2. Timber berth or permit number
3. Name of licensee or permittee and address
4. Ranger district number
5. Map of sale area
6. Terms of sale contract (Notice of Sale)
7. Total sale acres
8. Species present and volume
9. Average diameter B.H.
10. Average volume per acre
11. Volume tables used to compile estimates
12. Decision to mark by species
13. Special operating conditions
14. Age class of the species sold
15. Why was the timber sold?
16. General condition of timber to be marked

The above information is passed to the marking crew foreman who will be responsible for marking of the sale area. Any pertinent verbal information should be discussed with the marking foreman at this time.

20.8.2 Control of Marking

The marking crew foreman, on arrival on the sale area, should determine his location on the berth or permit area by tie-in to a survey mound or other defined tie point. If the boundaries are run, no further work of defining the sale area is necessary. If the boundaries are not run and are not "natural" ones they should be defined in sufficient detail to allow proper marking of the area. They should all be run if any marked sales adjoin the area to be marked. The licensee or permittee should accompany the marking crew foreman when boundaries are being defined.

The sale area should then be blocked into marking areas or blocks of 40 acres or one legal sub. in order to keep control of the marking area. Such blocking of the sale area may not be necessary if the sale is broken up by well defined stream courses or other natural means of definition, or if the area is small enough to be completed at the initial marking. The marking areas should be defined by easily recognized lines, such lines need not be as well defined as the berth boundaries.

20.8.3 Field Procedure

Once a marking area is defined within the sale, a reconnaissance of the area is the next step. In this manner the marker will thus familiarize himself with the map, timber types, topography, etc., prior to actual marking to produce best results in a reasonable time.

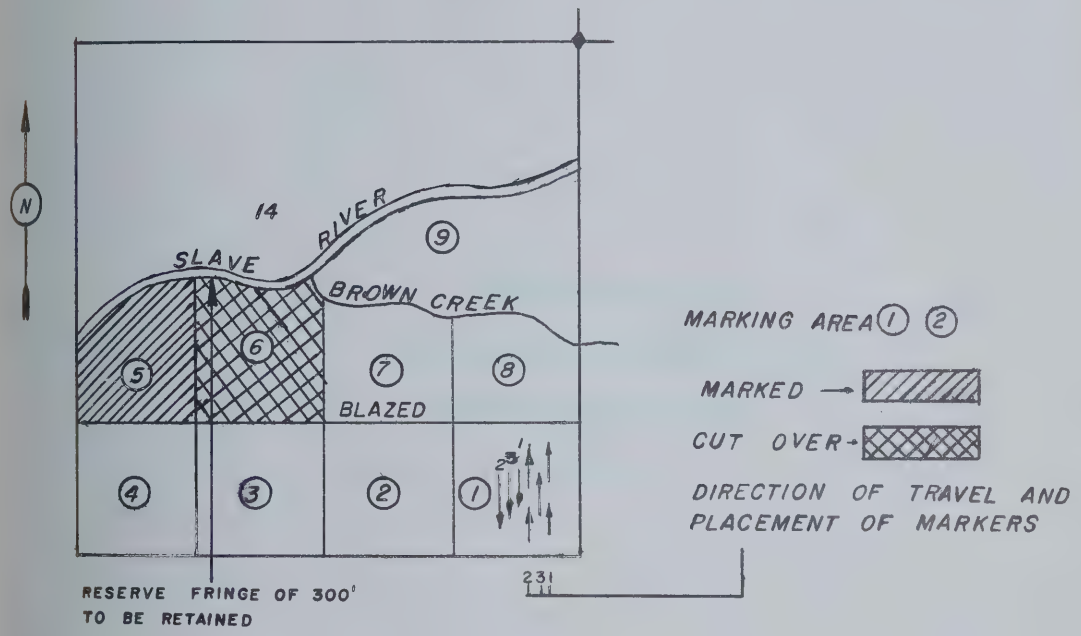
The crew usually consisting of three men spread out along the boundary of commencement. Each man is 1/2 to 1 chain distance from his partner and is responsible therefore for marking a strip of timber equal to the distance between crewmen. Strip width is primarily dependent upon stand density and a one chain width is generally the most practical size. His centre line of strip

is his initial position along the line. One man follows the berth or permit boundary and the next man follows a course parallel to the first. The third man or marker remains in the centre of the strip in order to maintain the designated direction and select the trees to be marked. When the line of three men reach the boundary of the "marked area" they then wheel in such a way as to place the "boundary" man (one) in the farthest position on the return strip and the second man on a strip adjacent to his initial strip, thereby eliminating the possibility of missing trees which should be marked as well as facilitating the task in other ways.

Crew progress will be followed on the maps and photographs by the marker. By this means, areas that do not contain timber authorized to be cut will be avoided.

Periodic sampling employing quarter acre rectangular plots in recent cut-over areas is required to check on the relative volume removed, inspect the results of marking and to determine if only marked trees are being cut.

See illustration below:



20.8.4 Marking Records

Simple routine records should be kept for all marking. An individual marking file for each marked sale should be set up and should contain the tally sheets, compilation sheets, tree scale summary sheets and progress map. If the marking is to be done in stages a progress map should be kept up to date with data summarized at the completion of each stage. Where sale is divided into marking units, records should be kept by these units.

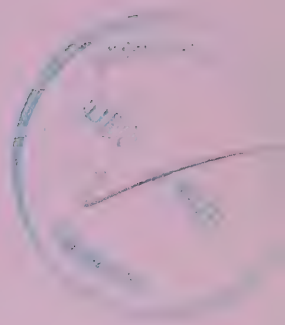
Each tally sheet should be completed in detail and the daily volume compiled and entered on the daily tree scale summary sheet. The original and duplicate copies being submitted to the Forest Superintendent who will in turn forward one on to head office.

Alberta

LANDS AND FORESTS

Forest Service

Timber Management Branch



TIMBER MANAGEMENT

ALBERTA SCALING INSTRUCTION

SAW AND PEELER LOGS

CHAPTER 21

Effective July 1st, 1973

TIMBER MANAGEMENT

CHAPTER 21

ALBERTA SCALING INSTRUCTION

SAW AND PEELER LOGS

SECTION

INTRODUCTION

REQUIREMENTS OF A SCALER

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INTRODUCTION TO SCALING

The measurement of logs to ascertain their contents is called scaling. Scaling is not a guess but a scientific estimate based on certain fundamental rules tempered with experience.

Although there are various purposes for scaling, the main purpose of scaling is to measure the volume of the forest product being sold.

There are three general scaling methods used in Alberta:

A. By Board Foot Measure [International 5/16 Inch Log Rule].

B. Solid Volume, the unit of measure being the cubic foot. [Alberta Cubic Foot Rule, Cubed Pulpwood Instructions].

C. Apparent Volume, the unit of measure being the cord of 128 apparent cubic feet, or the equivalent of a pile of wood 4 Ft. x 4 Ft. x 8 Ft. [Pulpwood Instructions – stacked wood].

REQUIREMENTS OF A SCALER

When scaling or measuring Crown timber a scaler is determining the amount of government property passing into private ownership and the amount of revenue from the sale of that property. It is his duty, holding an Alberta licence or permit to scale and being responsible to the Department, to determine these amounts fairly and accurately.

Scaling, as practised by the Department, is a measurement related to the quantity of sound merchantable wood rather than the quality. It is therefore the scaler's duty to scale in accordance with the volume of a certain product and not in relation to any particular grade of material that is produced.

The scaler must have sound and impartial judgement, confidence in that judgement and a tenacity that will withstand negative opinions, except when accompanied by substantial evidence. The scaler must base his judgement on a thorough understanding of the following factors:

A. The scaling rules and regulations governing scaling practices in the Province of Alberta.

B. In addition to being familiar with the basic procedures for scaling a scaler must be aware of any agreement stipulation that may appear in contract between the Department and a company and how they may be co-ordinated with the basic scaling procedures.

C. The defect characteristics of the different species in the area.

D. The defect characteristics of trees taken from different sites within the area. Both mechanical and pathological defects vary with the difference in sites.

E. The identification of the different tree species in the area.

Time alone does not make a scaler qualified. His training must be thorough and the results of his work accurately checked. A scaler must at all times realize that he is the Department's representative on the operation and it is his duty to report all matters of interest to the district Forest Officer. This includes matters other than scaling.

ASSURANCE TO PURCHASERS

No assurance regarding Departmental scale will be made to purchasers, except that provincial timber will be scaled in accordance with instructions for scaling, without modification because of the favourable or unfavourable market conditions or other factors which may influence the amount of recovery or even prevent the manufacture of the amounts scaled. Every effort will be made to keep the scaling practice uniform.

21.1

UNIT OF MEASURE

A board foot represents a solid piece of wood 12 inches wide, 12 inches long and 1 inch thick. The board foot is a unit of measure chosen originally by industry because it expressed the merchantable contents of a log in terms of the finished product.

The volume of sawlogs and peeler logs scaled by the International 5/16 inch rule is recorded in terms of F.B.M. [Foot Board Measure].

21.2

INTERNATIONAL 5/16 INCH LOG RULE

The measure of logs to ascertain their contents is called scaling. The instrument used for measuring logs is called a scale stick, scale rule or log scale.

A number of different types of log rules have been manufactured; however, where timber is offered for sale by the Department on a log scale basis, the International 5/16 Inch Log Rule shall be used. [Section 21.15.4]

21.3

NUMBERING AND RECORDING LOGS

Every log, whether merchantable or cull must be numbered with crayon or other approved means at the time it is scaled. The number should be placed on the small end of the log.

The attached Form FM 83 [405] shows the contents of logs in FBM in relation to the diameter [along the side] and the length [across the top].

The scale of each merchantable log will be entered opposite the log number on the scale sheet [Form No. 505A] in the column provided for that species.

Example: A sound log measuring 10 inches and 16 feet long should be entered as shown.

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	26	10 16		6 2
	27			

The numbering of logs is essential as it permits check scaling at any time, allows a check on total pieces thus preventing the missing of logs and also is a safeguard against lax scaling as scaler is responsible for each individual log.

The use of red crayon or red colors for marking is reserved by the Alberta Forest Service and no unauthorized person shall use this color for marking or scaling of any logs or bolts.

21.4

SPECIES

Dues of balsam fir differ from dues of spruce, pine and douglas fir. The rate of dues for balsam fir is applicable when timber is cut under a Licence or Permit, if the timber is measured in log or tree form by a person authorized by the Director and recorded separately from the other species of timber cut. [Refer to General Rate of Crown Dues].

21.5

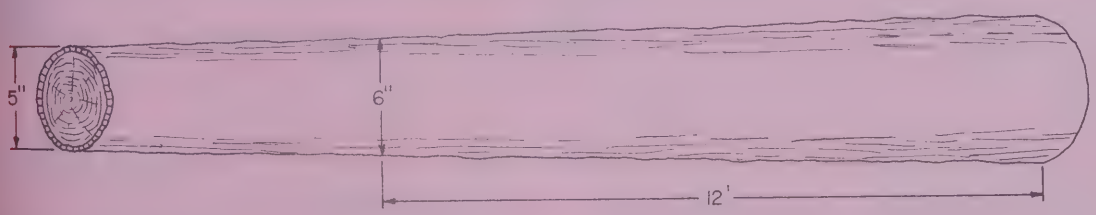
MEASURING LOG LENGTHS

The scaler will measure the length of every log about which there is any question. In addition, the length of logs in the general run will be measured frequently enough to make sure that the specified trimming allowance is not exceeded.

When a portion of a log is unmerchantable due to its top diameter being less than the utilization requirements of a licence or agreement, the length of the log may then be reduced to where the specified minimum diameter falls. Prior to scaling the scaler should be familiar with the minimum top sizes that has been specified for the material being scaled.

Example:

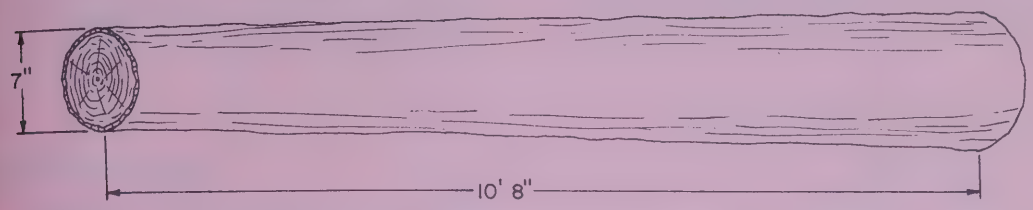
A 5 inch top on a licence requiring utilization to 6.0 inches.



Scale as 6 Inches x 12 Feet

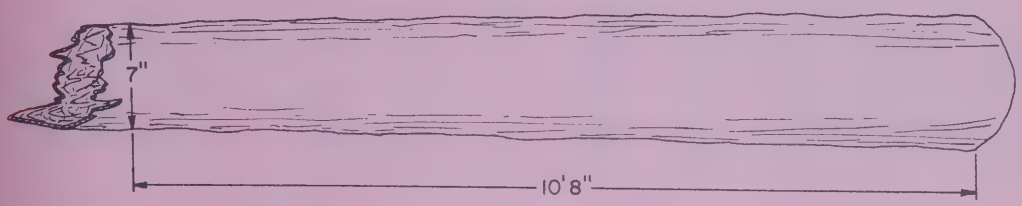
Logs having diameters over 6.0 inches and logs with sound broken tops resulting from obvious mechanical damage should be treated as follows:

Example:
Top Logs



Scale as 7 In./11 Ft.

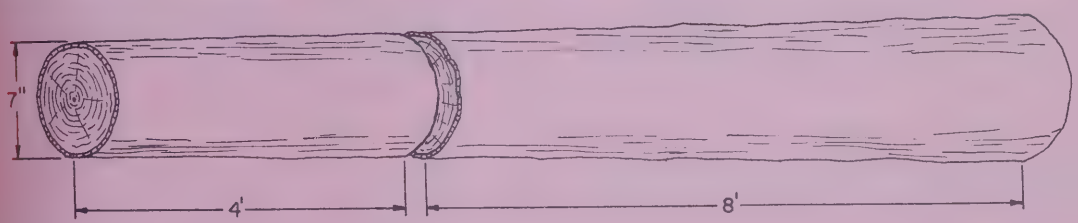
Sound Broken Tops



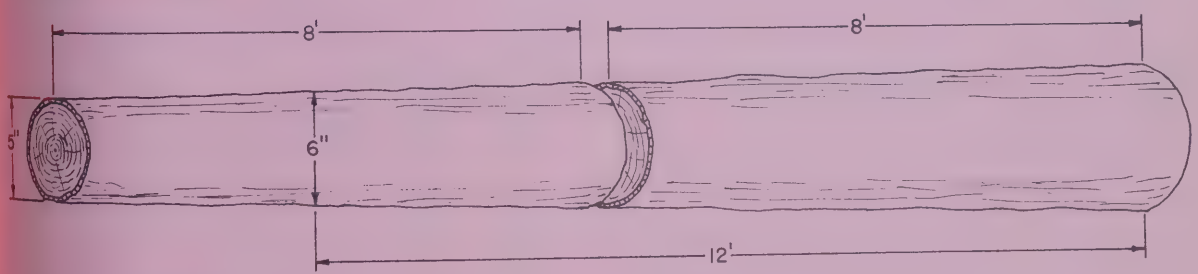
Scale as 7 In./11 Ft.

Log lengths may be recorded at one foot intervals from six to twenty feet. A minimum scaling length of 8 feet can be considered providing bucking practices have taken utilization into account. When bucking is done in one standard length, [i.e. 8 ft.], without regard to utilization, material should be considered to full length or 6 inch top.

Example:
Bucking done at 8 ft. intervals.



Scale as 7 In./12 Ft.



Scale as 6 In./12 Ft.

If top logs are mixed up and cannot be identified with the remainder of the tree, an alternate method may be used by applying a volume for the top logs.

i.e. Assume volume for a 5 inch/8 foot log having some 6.0 inch material is equivalent to 6 inches/4 feet = 3 F.B.M.

21.6

TRIMMING ALLOWANCE

The trim is designed to make allowances for large butt logs, where the undercut is uneven, and to make allowances for top of large first and second logs where there is a variation in the bucking.

[a] Sawlogs – Trim allowance for sawlogs shall not be less than two inches or greater than six inches. Four inches is the optimum trim.

[b] Peeler L[illegible] – Trim allowance shall not be less than six inches or greater than eight inches.

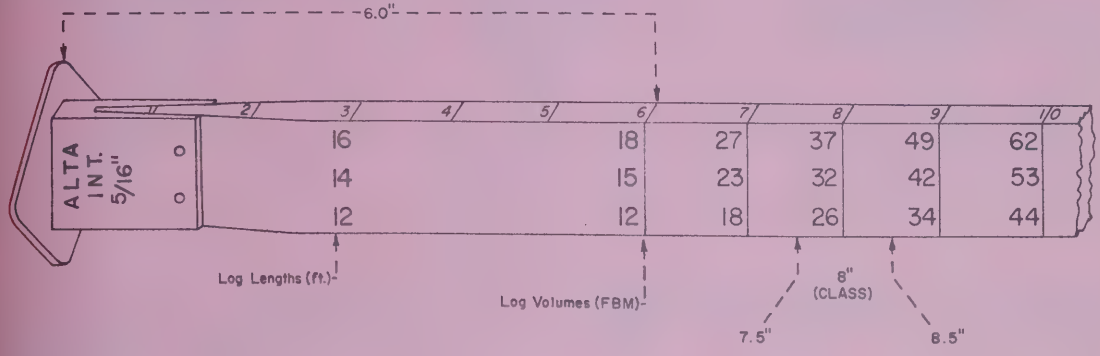
Any log overrunning the trim allowance will be scaled to the next foot in length. i.e. A sawlog.

Example: A sawlog with 12 inch top and 16 Ft. 8 In. long would be tallied as 17 Ft.

21.7

THE SCALING STICK

The original International 5/16 inch rule has graduations on the one inch mark as shown below.

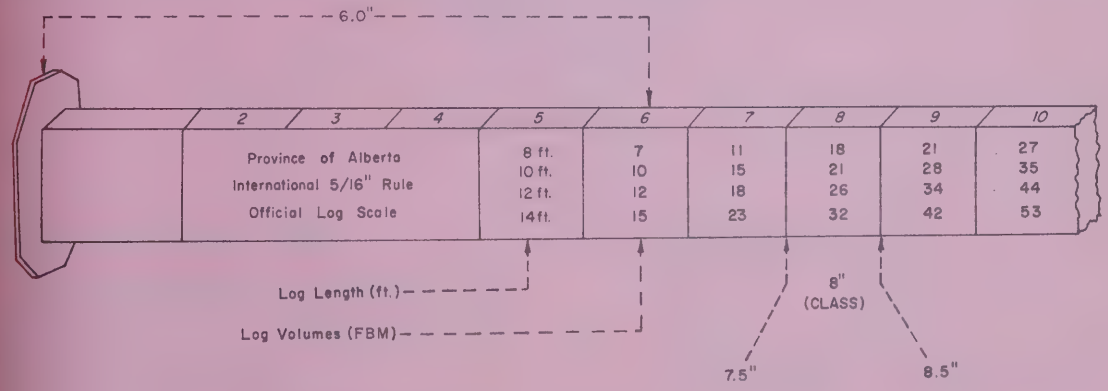


Original Rule

Each inch class includes measurements 1/2 inch below the graduations to measurements 1/2 inch above the graduations as shown above.

The scale stick standards have been revised to provide that diameters on the scale stick be marked off in diameter classes rather than on the inch. New scale sticks using diameter class graduations are being manufactured by Robert's Industries Ltd. and are distributed to various logging companies through the Alberta Forest Products Association.

The new rule with graduations on the 1/2 inch mark is shown below:


6.0"
2 3 4 5 6 7 8 9 10
Province of Alberta
International 5/16" Rule
Official Log Scale
8 ft. 7 11 18 21 27
10 ft. 10 15 21 28 35
12 ft. 12 18 26 34 44
14 ft. 15 23 32 42 53
Log Length (ft.)
Log Volumes (FBM)
8" (CLASS)
7.5"
8.5"

New Rule

Since two kinds of sticks will be in use for some time, it is necessary to check the stick being used to ascertain whether diameters are marked off in inches or inch classes.

When using a scale stick the volume for odd length logs can be obtained by averaging two even lengths.

Example:

For 12 In./17 Ft. Log
Average
12 inch/16 feet and 12 inch/18 feet

$$93 + 107 = \frac{200}{2} =$$

100 FBM.

21.8

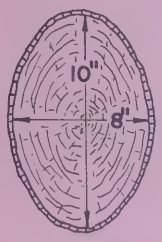
TOP DIAMETER

If the log is exactly round only one measurement is required. The top diameter is measured inside the bark to the nearest inch and recorded in that particular inch class. For example, a diameter which measures within 11.6 inches to 12.5 inches would be considered as in the 12 inch diameter class.

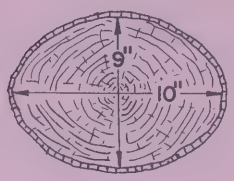
It is common to find that ends of logs being measured have an oval rather than circular shape. The scaling diameter of an oval shape log is taken as the average of the maximum and minimum diameter classes found by measuring respectively across the widest and narrowest faces of the log.

If the average of two diameter classes comes to a figure with a half-inch [for example, 12 + 15 = 27÷2 = 13.5], the closest even figure is taken as the diameter for scaling.

$\frac{8+9}{2} = \frac{17}{2}$ = 8.5 to 8 inches



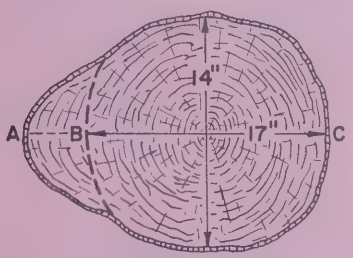
$\frac{8+10}{2} = \frac{18}{2}$ = 9 inches



$\frac{10+9}{2} = \frac{19}{2}$ = 9.5 to 10 inches

Top Diameter Measurements

In obtaining the average diameter of bolts care should be taken to ignore slight abnormal swellings. For instance, in the figure below, BC rather than AC should be taken in determining the diameter. The average diameter would be 14 + 17 = 31 ÷ 2 = 15.5. Taken to the even inch the bolt would be scaled as 16 inches.



Abnormal Swelling

21.9

DEFINITION OF CULL LOGS

Logs that contain less than one-third sound volume as determined by the volume or percentage method of making deductions are defined as Cull logs and no volume is considered in the scale.

The gross scale of each cull log presented for scaling will be entered opposite the log number in the scale book in the column provided for defect and the word 'cull' or the letter 'C' entered after the gross scale.

Cull logs scaled and entered on the scale sheets will be counted as pieces and reported as logs of their particular species.

Example:

12 In./16 Ft. log = 93 FBM

Deduction = 63 FBM
Remainder = 30 FBM

Log is considered as cull and should be entered on scale sheet as shown.

Species	No.	Dim's D/L	Cull & Ded's			Net Scale			
	1	12 / 16			9	3			C
	2								

21.10

DEDUCTIONS FOR DEFECTS

The effects of rot or other defects upon logs varies greatly dependent upon different species and different regions. The following are some classes of defects commonly referred to.

[a] Interior Defects
- Centre or heart rot
- Butt rot
- Shake or split
- Heart check
- Pitch ring

[b] Exterior or Side Defects
- Sap rot
- Frost, wind or sun checks
- Catface or fire scar

[c] Defects of form
- Crook or sweep
- Crotch or fork

Scalers constantly must exercise good judgement based on knowledge of local timber obtained by watching defective logs opened up under the saw. Although no fixed rule can be made in regard to deduction practices, the following must be considered when making deductions:

[a] No deductions are made for sound stained logs unless authorized by the department. Lumber may be off color and appear rotten, but at the same time it is quite sound and merchantable as a poor grade. Two common types of stain may be encountered in scaling.

1. Red stain is not considered a defect unless it has reached the buttermilk or honeycomb stage.
2. Blue stain generally affects sapwood on logs that have been piled for some time or on logs killed by bark beetles or fire.

[b] Length of cull should be based on each individual merit regardless of the recoverable length of remaining material. Recoverable lengths are subject to bucking, trimming and marketing practices thus cannot be considered in relation to deductions.

[c] No deductions will be made for mechanical defects due to poor logging practices.

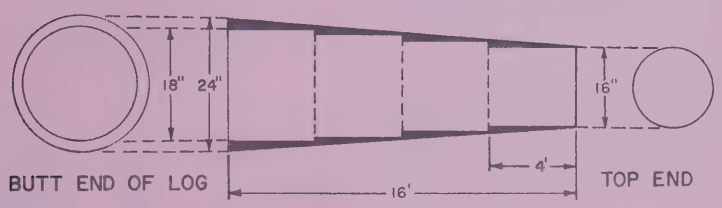
21.11

THE CONSIDERATION OF SCALING CYLINDER IN MAKING DEDUCTIONS

The International 5/16 Inch Rule is based on a formula which is applied to each 4 foot section of the log and an assumed taper of 1/2 inch in each 4 feet. Figure A illustrates the scaling cylinder of a log by 4 foot sections for practical purposes however, it may be assumed that the scaling cylinder becomes a frustrum of a cone with a taper of 2 inches in 16 feet as shown in Figure B.

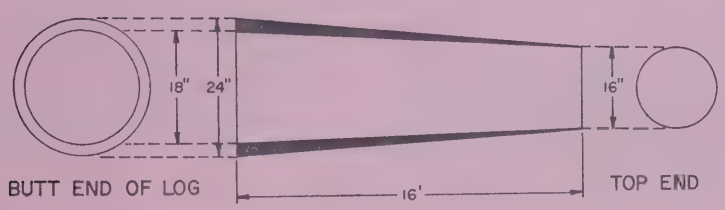
Scaling cylinder conception by 4 foot sections. Material in excess of taper allowed in log rule.

Figure A



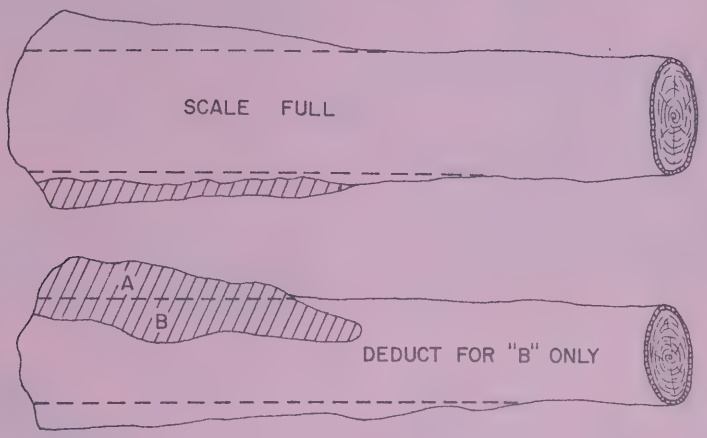
Cone frustrum conception as substitute for scaling cylinder. Material outside scaling cylinder.

Figure B



The log rule contemplated a 1 inch collar for slab, therefore, in FBM scaling in Alberta no deduction will be made for defect falling outside the scaling cylinder or in the slab.

The following examples show consideration of scaling cylinder in making deductions.



21.12

METHODS OF DEDUCTION

The following pages show methods of making deductions along with suggested uses:

21.12.1

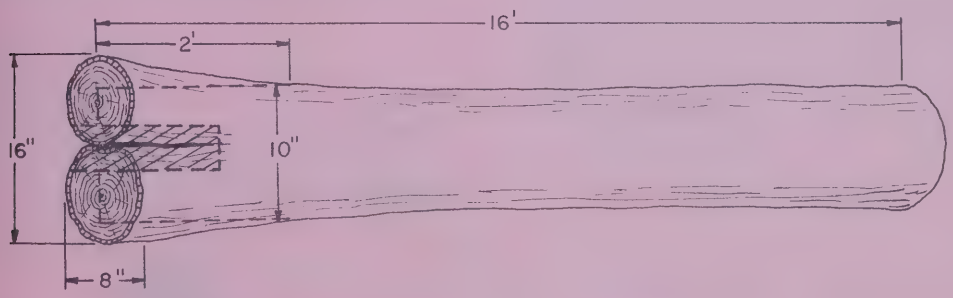
REDUCTION BY LENGTH

Reduction in length gives a proportionate reduction of total contents depending on the length of the log before and after reductions. This is a reasonable sound practice in certain cases of butt rots, splits, butt checks, crotch and crook.

21.12.1.1

CROTCH

If the crotch is cut off so close to the point of departure from the main stem that the surface of the end of the log is unbroken by bark or split no deduction will be made:



If a deduction is necessary as in the figure then the log is reduced in length by the length of the swollen portion. The log would be scaled as a 10 inch 16 foot log as shown, with net scale for a 14 foot log.

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	26	10 / 16	9	5 3
	27			

21.12.2

REDUCTION BY DIAMETER

Reduction in diameter is occasionally used to compensate for certain kinds of defects, but as the percent of the scale varies for all diameters for each difference in the number of inches subtracted, the greatest caution must be exercised by the scaler using this method.

Example:

Reduce 7 in./16 ft. log to 6 in./16 ft. log = 27 – 18 = 9 ft. [FBM] [33%]
Reduce 16 in./16 ft. log to 15in./16 ft. log = 172 – 150 = 22 [FBM] [13%]

Reduction in diameter is recommended only in cases of sap rot, external checks or worm holes.

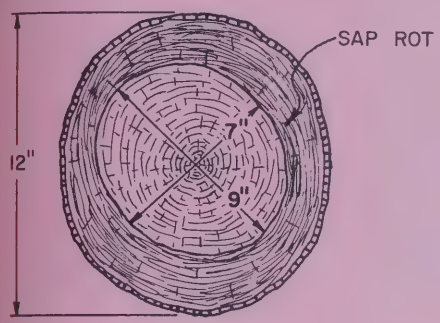
21.12.2.1

SAP ROT

It is common to find that logs which have been on the ground for many years, or came from dead snags, will have sap rot in a more or less advanced stage of decay. As a rule, the heartwood is still sound, but the sap-wood will be unusable. In such cases, the net scale is obtained by scaling only the sound heart.

No deduction will be made for sap rot due to unnecessary delays in presenting logs for scaling.

If log is 16 foot long then it would be tallied as shown.



Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	51	12 / 16	5 6	3 7
	52			

21.12.3

DEDUCTION BY PERCENTAGE

The practice is to tally logs full size and make a percentage deduction from the total volume. This method is used in the case of sweep or crook.

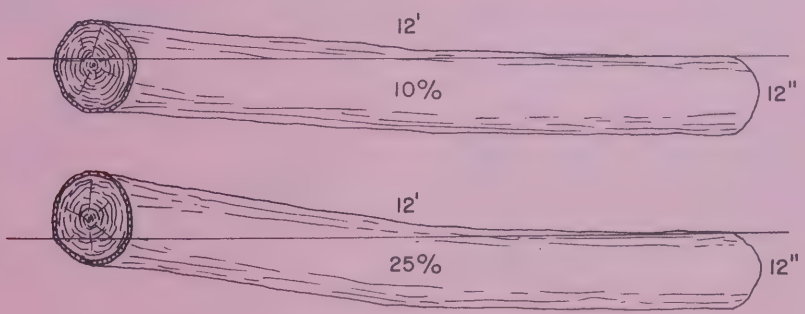
21.12.3.1

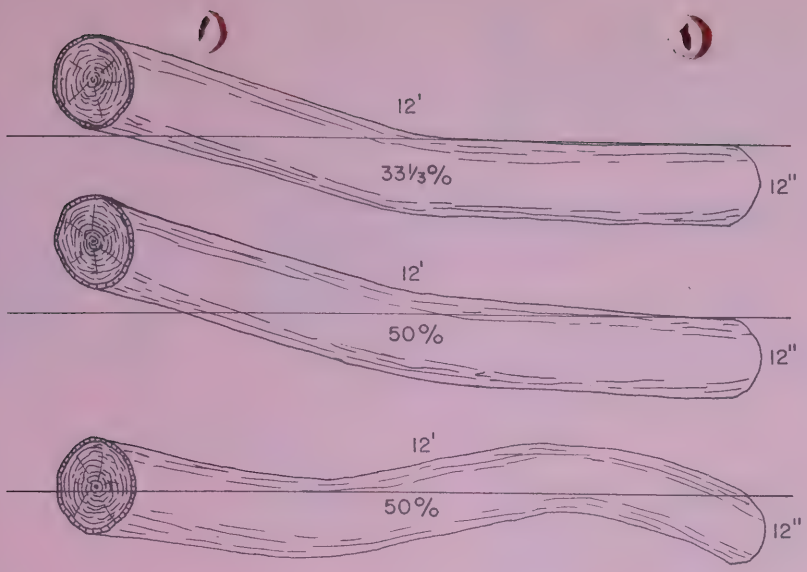
SWEEP OR CROOK

The log rule allows for normal crook which is estimated at about 1.5 inches and does not exceed 4 inches on a 12 foot log. Any crook more than 4 inches will have to specially be discounted by the scaler.

Crook and sweep in logs can usually be minimized, and frequently practically eliminated by expert bucking. This is particularly true where short logs commonly are cut. Scalers must be on the alert to detect and correct continued poor bucking causing unnecessary loss from crook or sweep. If an operator persists in such practices, after adequate warnings, no allowance will be made for crook or sweep until bucking is improved.

The following diagrams serve as a guide, scaled and recorded as shown:





Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	51	12 / 12	7	59
	52	12 / 12	16	50
	53	12 / 12	22	44
	54	12 / 12	33	33
	55	12 / 12	33	33

21.12.4

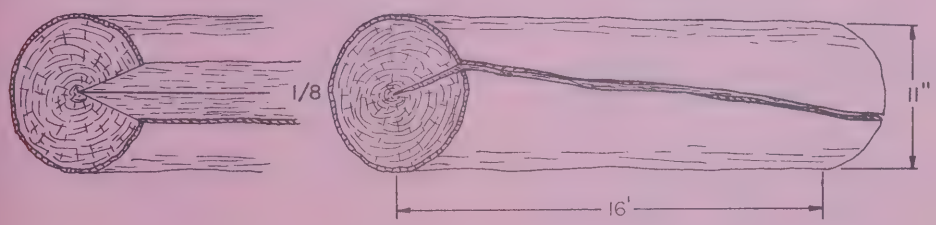
DEDUCTION BY SECTIONS

The method is convenient for reducing the scale when side defects such as pitch seams, surface rot, lightning scar and catface are encountered. The defective portion is enclosed in a V-shaped area representing a sector of a circle. The resulting fraction being deducted from the gross scale.

21.12.4.1

LIGHTNING SCAR

Assume a log 16 feet in length and a top diameter of 11 inches with a deep scar or seam running the full length in a straight line.



Gross Scale	11 in./16 ft. log	=	76
1/8th of Scale	[9.5]	=	10
Net Scale		=	66 FBM

Record as shown

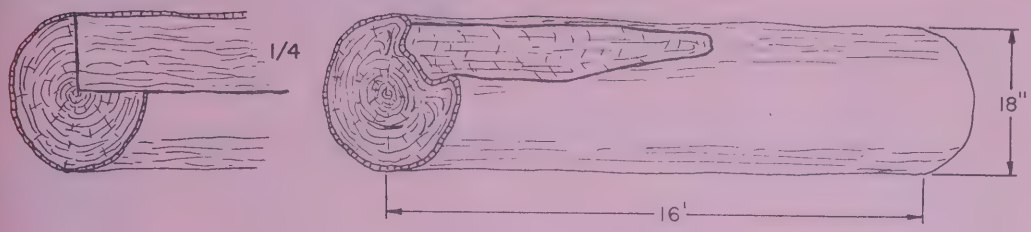
Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	76	11 / 16	10	66
	77			

21.12.4.2

CAT FACE

In deducting for catface only that portion falling into the scali. Cylinder will be deducted for.

The defect occupies a sector equal to 1/4 of the end of the log, however, as the defect extends 1/2 the length, only 1/8 of the volume need be deducted.



Gross Scale	18 in./16 ft. log	=	222
1/8th of Scale		=	28
Net Scale		=	194 FBM

Record as shown

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	26	18 / 16	2 8	1 9 4
	27			

A reduction in length is sometimes made for this type of defect. i.e. 18/14 ft. = 191 FBM

21.12.5

STANDARD RULE DEDUCTION

The scaler first measures the end dimensions of the square or rectangle which will be wasted in manufacture and determines the length. The incidental loss, which will ordinarily be taken to be 1 inch, is added to the actual height and width of the defect to give its total dimensions.

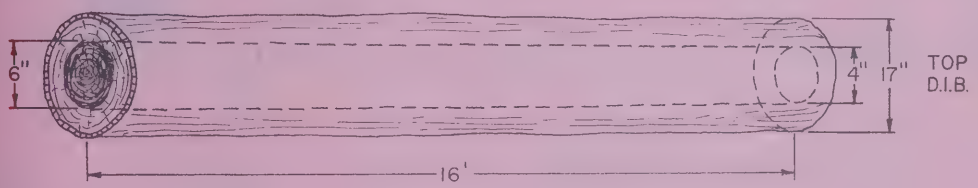
The Standard Rule:

$$\text{Deduction} = \frac{[\text{W in.} + 1] \times [\text{H in.} + 1] \times \text{L ft.}}{16}$$

21.12.5.1

CENTRE OR HEART ROT

Assume a log 17 inches in diameter inside bark at the small end and 16 feet in length with a heart rot extending clear through the log, 4 inches in diameter at the small end and 6 inches at the large end.



For deduction take the measurements of the large end of defect and apply the standard rule, 1 inch is allowed for waste in sound material which will be wasted in sawing out this defect.

Gross Scale	17 in./16 ft. log	=	196
Deduction	$\frac{7 \times 7 \times 16}{16}$	=	49
Net Scale		=	147 FBM

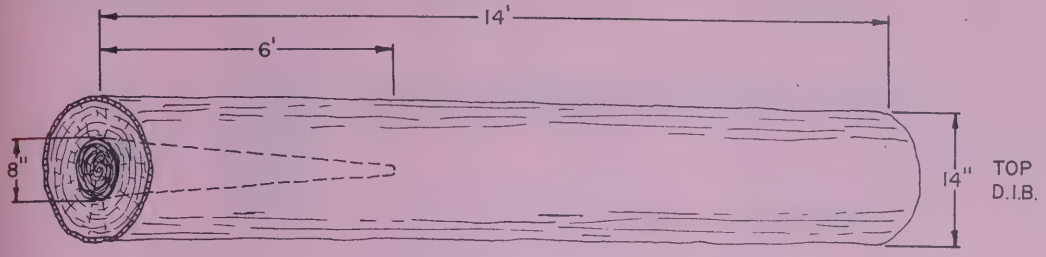
Record as shown

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	76	17 / 16	4 9	1 4 7
	77			

21.12.5.2

BUTT ROT

Butt, or stump rot is a common defect which seldom extends beyond 5 or 6 feet into a butt log and generally tapers to a point. Figure shows a log 14 feet in length with a top diameter inside bark of 14 inches having butt rot 8 inches in diameter and extending 6 feet into the log:



Gross Scale 14 in./14 ft. log = 111
Deduction $\frac{9 \times 9 \times 6}{16}$ = 30

Net Scale = 81 FBM

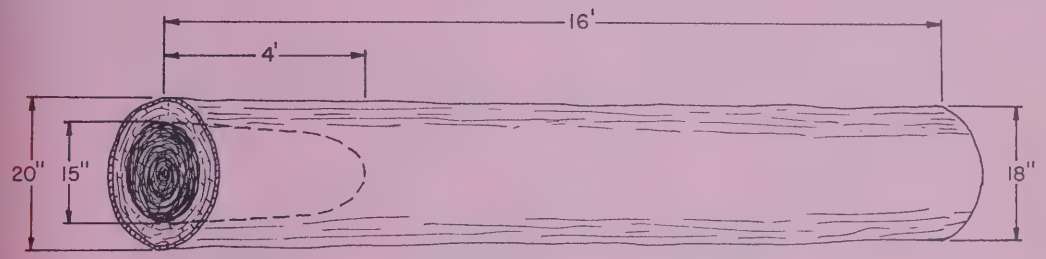
Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	51	14 / 14	3 0	8 1
	52			

Record as shown

21.12.5.3

EXCESSIVE BUTT ROT [reguire deduction by length]

When the diameter of the defect is so large as to approach the diameter of the scaling cylinder the volume of the squared defect is greater than the board foot volume of a scaling cylinder having the same diameter. Therefore, in cases where the deduction obtained by the standard rule is greater than the deduction obtained by reducing the length of the log [for the same length of defect] the reduction in length method will be used.



Incorrect

Gross Scale 18 in./16 ft. log = 222
Deduction $\frac{16 \times 16 \times 4}{16}$ = 64

Net Scale = 158 FBM

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	76	18 / 16	6 1	1 6 1
	77			

Correct:

Net Scale 18 in./12 ft. log = 161 FBM

No fixed rule can be established as to distance stump rot will extend into the log.

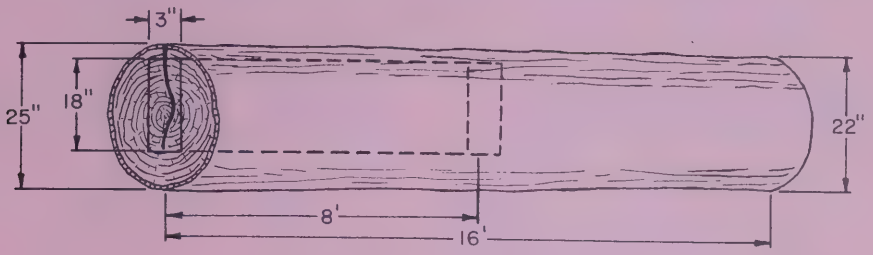
Record as shown.

21.12.5.4

HEART CHECK, FROST CRACK

It will be noticed that although the defect extends to the outer edge of the log, deduction is made only for that portion which is inside the scaling cylinder. One inch included in both height and width of defect in order to apply standard rule.

[Note: Crack in the Figure extends only 8 feet into log]



Gross Scale 22 in./16 ft. log = 338

Deduction $\frac{3 \times 18 \times 8}{16}$ = 27

Net Scale = 311 FBM

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	26	22 / 16	2 7	3 1 1
	27			

Record as shown

Heart check is often twisted, and when it passes through the log and comes out at a different angle the deduction will necessarily have to be increased to allow for the loss of lumber due to short lengths.

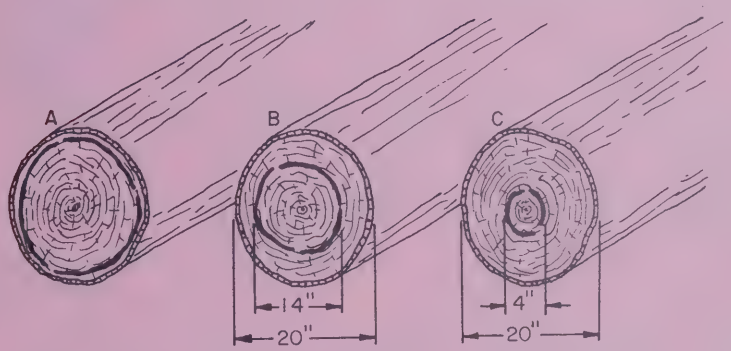
No deductions will be made for checks due to unnecessary delays in presenting logs for scaling.

21.12.5.5

SHAKE OR PITCH RING

Shake or pitch ring are the same in that they are due to the separation of the annual rings. They differ, however, in that the pitch ring is filled with pitch. The problem of deducting for defect is the same in both cases.

The scaler must be very careful to note the location of the ring.

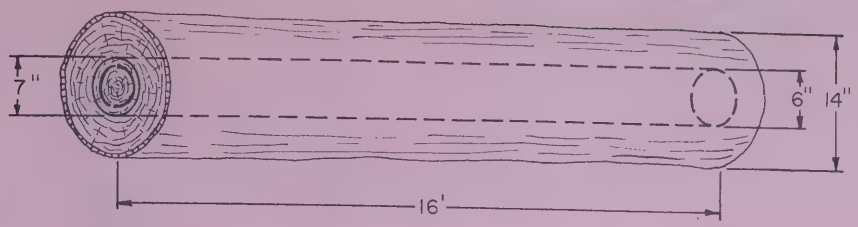


[a] If the ring is outside the scaling cylinder, there is no deduction for defect.

[b] If the ring is in the outer three inches of the scaling cylinder where it would be impossible to cut merchantable material from the outer ring, the scaling diameter of the log is taken inside the ring. An open ring is likely to extend farther into the log than a closed ring.

[c] If the ring is in the heart of the log where no merchantable material can be realized from the core within the ring a diagram is superimposed around the ring and the standard rule applied.

Deduction for defect caused by ce shake.



[d] The figure illustrates a 14 inch, 16 foot log with centre shake 7 inches in diameter extending all the way through the log. Note that 6 inches interior of bolt is considered.

Gross Scale	14 in./16 ft. log	=	129
Deduction	8 x 8 x 16 / 16	=	64
		=	65
Add on interior log	6 in./16ft.	=	18
Net Scale		=	83 FBM
Net Deduction	64 - 18	=	46 FBM

Species	No.	Dim's D/L	Cull & Ded's	Net Scale
	1	14 / 16	4 6	8 3
	2			

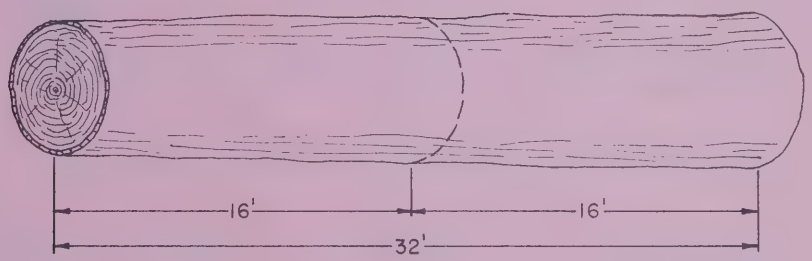
21.13

SCALING OF LONG LOGS

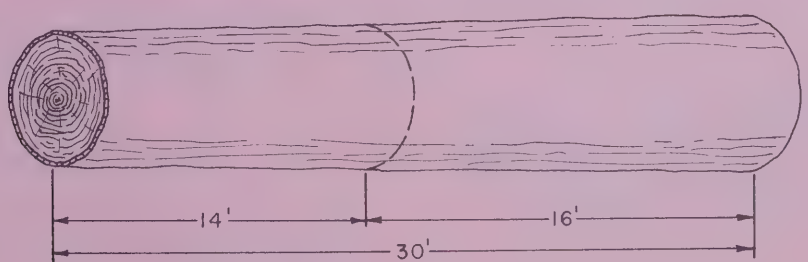
21.13.1

LENGTHS

Logs over 20 feet in length will be scaled as two or more logs of standard length, each as nearly the same standard length as practical. [Trim allowances have been omitted below for illustration purposes].



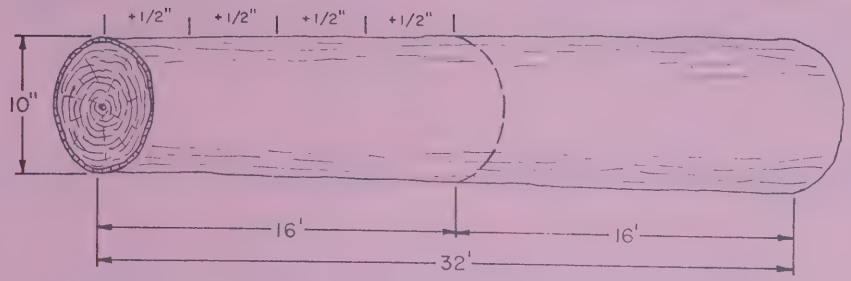
If a log must be divided into unequal lengths, the butt log should be the longer.



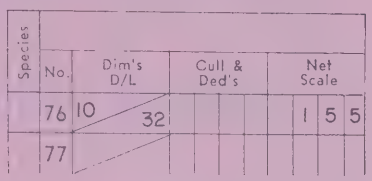
21.13.2

DIAMETERS

The top diameter of the butt log will be calculated from the diameter of the top log and adding on the taper allowance. [1/2 inch in 4 feet].



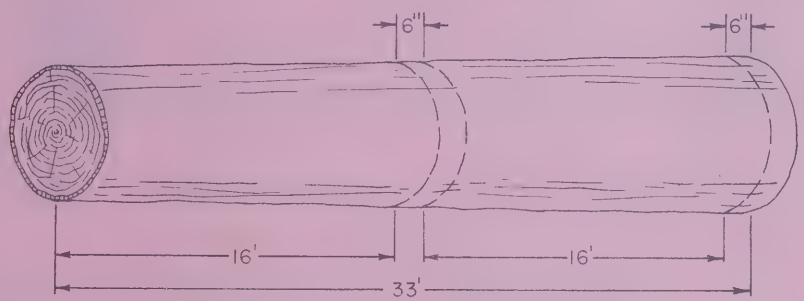
Top Log	10 in./16 ft.	=	62
Butt Log	12 in./16 ft.	=	93
Total		=	155 FBM



21.13.3

TRIM ALLOWANCE

When long logs are divided into two or more logs for scaling, the prescribed trimming allowance should be permitted for each log into which the long log is divided, since the operator could have presented the logs for scaling in that manner, if so desired.



Scale as 2 - 16 foot logs

21.13.4

CROOK OR SWEEP IN LONG LOGS

If crook or sweep occurs in long logs which are scaled as two or more logs, allowance will be made only for so much of the defect as cannot be eliminated when dividing the log into shorter sections for scaling. All deductions may be assessed in same manner as for short logs.

21.14

SCALING OF PEELER LOGS

Coniferous [Pine, Spruce and Fir] logs will be scaled the same as sawlogs. Logs unsuitable for peelers may be utilized by sawing. Poplar peeler logs may be selected according to the following merchantability standards.

Merchantability standards for poplar peeler logs are as follows:

21.14.1

DIAMETERS

Diameters below 12 inches top d.i.b. will be considered unmerchantable except for absolutely straight, sound logs which will be utilized to a 10 inch minimum top diameter [d.i.b.].

21.14.2

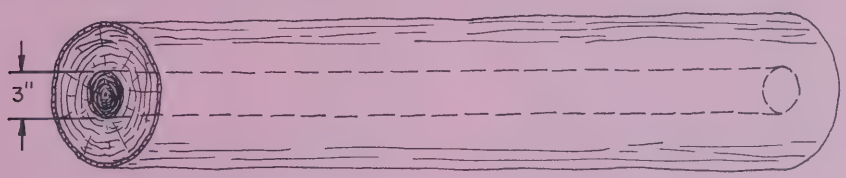
KNOTS

Surface must be clear of knots except for knots up to 1 1/2 inches in one quarter of the log.

21.14.3

BUTT OR HEART ROT

Butt Rots or heart rots must not exceed 3 inches in diameter when located in the centre of the log.



21.14.4

RING SHAKE

Visible ring shake may not cover more than one quarter of the log.

21.14.5

SPLITS, FROST CRACKS

No open splits or frost checks extended to surface of log are allowed.

21.15

THEORY OF SCALING

21.15.1

BOARD FOOT RULES

Log scaling is the measurement of logs by a unit of measure called a log rule. Log rule tables give the volume for each diameter and length is expressed in foot board measure.

There are many log rules in existence, because various interested persons have devised or revised rules in efforts to get the closest possible approximation of the volume of lumber obtained from logs of different dimension under the conditions in specific localities. At best, it is only possible for a log rule to approximate manufactured volume, because of constant change in markets, machinery, sawing practices, and even the varying skill of individual sawyers. Thus a log rule becomes an arbitrary unit of measure.

There are two main types of board foot rules based on the method of construction. These rules are based on mathematical formulae or on diagrams. Regardless of how the rule was derived there are certain assumptions that must be made. These include:

[a] The log is a cylinder having a diameter equal to the diameter inside bark at the small end and a length equal to that of the log.

[b] Logs are cut into boards 1 inch thick.

[c] The width of the saw, or sawkerf. Sawkerf allowances vary from 1/8 inch to 3/8 inches.

[d] Boards are utilized to a specific minimum width.

[e] The minimum length of the board cut is equal to the length of the log.

[f] The log is free of defects.

21.15.2

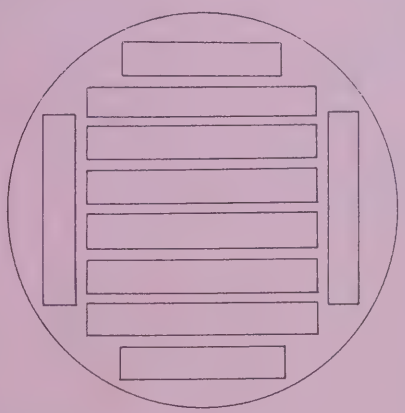
FORMULA RULES

Log rules derived from mathematical formulae use the volume of a cylinder as the basis from which deduction for slab, kerf and sometimes shrinkage are made in order to arrive at the merchantable volume of the log.

21.15.3

DIAGRAM RULES

The second type of log rule is based on diagrams of circles showing 1 inch boards that can be cut from a cross section equal in diameter to that of the small end of the log. The width of the sawkerf and the minimum width of a merchantable board must be assumed. A diagram is prepared for each diameter class. The total number of square inches included within the boards that have been drawn in on the circle is divided by 12 to convert to board feet and the result multiplied by the log length in feet to get the number of board feet the log will yield. Diagram rules disregard any boards that can be recovered from the slab.



Showing 1 inch boards that can be cut as employed by diagram rules.

21.15.4

INTERNATIONAL 5/16 INCH LOG RULE

This rule is based on the following principles:

[a] It shows the products of logs in boards one inch thick.

[b] It is based on the use of a saw cutting a specified kerf; viz. 5/16 inch.

[c] An allowance is made for taper of 1/2 inch for each 4 feet of length.

[d] Provisions are made for loss due to normal crook and that due to human and mechanical imperfections, such as end brooming, falling and skidding damage. By normal crook is meant the average crook of first class logs excepted at the average mill. The average crook allowed this rule is about 1.5 inches and does not exceed 4 inches on a 12 ft. log.

[e] An allowance of 1/16 inch for shrinkage and unevenness in sawing.

[f] The minimum board width is 3 inches, containing not less than 2 board feet. A 3 inch board must, then be at least 8 feet long to be included; a 4 inch board, 6 feet long; a 5 inch board, 5 feet long; a 6 inch board, 4 feet long.

[g] It presumes the use of good machinery and sawyers.

21.15.5

CONSTRUCTION OF THE INTERNATIONAL 5/16 INCH LOG RULE

The formula for the International 5/16 Inch Log Rule is derived as follows:

[a] Determining the volume of a cylinder Basal Area:

$$b = \frac{\pi D^2}{4} = .7854D^2$$

Volume of a Cylinder

$$Va = \frac{b \times L}{12} = \frac{.7854\ D^2}{12} \times 4 = .262D^2$$

b = Basal area of square inches
D = Diameter in inches
π = 3.1416
L = Log length in feet
Va = Solid wood volume of 4 ft. cylinder in board feet

[b] Deduction of kerf and shrinkage: Total thickness to produce a 1 inch board is as follows:

1 inch board + Kerf + Shrinkage [Kerf 1/8 in.]
16/16 in. + 2/16 in. + 1/16 in. = 19/16 in.

Of the total only 16/16 is usable

Therefore $16/19 \times 0.262D^2 = 0.22D^2$

[c] Deduction for slab allowance, edgings and normal crook. [Slabs deducted as board 2.12 in. thick, Diameter wide]

$$\text{Deduction} = \frac{2.12D}{12} \times 4 = .71D$$ [4 ft. log]]

Therefore volume of 4 ft. log with 1/8 in. sawkerf is as follows:

$$V = .22D^2 - .71D$$

The deduction for slab allowance etc. is equivalent to a 0.9 inch collar.

[d] Compensation for 5/16 Kerf On the basis of comparative waste from sawkerf alone a converting factor of 0.864 was derived and applied to the above formula to obtain the values for the 5/16 inch kerf. The formula for the 5/16 inch rule would then be:

$$V. = [0.22D^2 - 0.71D] \times 0.864$$ [four foot log]

[e] Applying taper to logs over 4 feet in length.
Average taper has been determined as 1/2 inch for 4 feet in length. Therefore, for a 16 foot log, the volume would be computed by increasing the diameter 1/2 inch for each 4 feet in length. The four expressions would then be added as follows:

$$V = [0.22D^2 - 0.71D] \times 0.864$$

$$V = \left(0.22[D + 1/2]^2 - 0.71[D + 1/2]\right) \times 0.864$$

$$V = \left(0.22[D + 1]^2 - 0.71[D + 1]\right) \times 0.864$$

$$V = \left(0.22[D + 1\ 1/2]^2 - 0.71[D + 1\ 1/2]\right) \times 0.864$$

The sum results in the following formula:

$$V = [.88D^2 - 1.52D - 1.4] \times 0.864$$

Which gives the volume of 16 foot logs.

21.16

OVERRUN AND UNDERRUN

The difference between the scaled volume and the lumber tally for a given log is called overrun or underrun depending upon whether the lumber tally is greater or smaller than the scale.

In measuring timber, the scaler should not vary the application of the rule being used. An overrun or an underrun is to be expected and it is not the duty of the scaler to make adjustments.

Overrun example:

Suppose Log Scale Volume	=	10,000 FBM
Sawed Volume	=	12,000 FBM
Overrun	=	2,000 FBM [20%]

Underrun example:

Suppose Log Scale Volume	=	10,000 FBM
Sawed Volume	=	8,000 FBM
Underrun	=	2,000 FBM [20%]

21.16.1

PRACTICES THAT INFLUENCE OVERRUN

[a] Cutting 2 inch or thicker stock thus saving the kerf. Board foot rules assume all boards cut would be 1 inch thick.

[b] Use of headsaw that cuts a smaller kerf than allowed for in the rule.

[c] Recovery of short lengths and lath from the slabs which the rule considers to be entirely wasted.

[d] Cutting boards of scant width or thickness, thus increasing the number of boards that can be cut from a log.

[e] The utilization of cull lumber from portions of the log that had been deducted from the gross scale because of defects.

21.16.2

PRACTICES THAT INFLUENCE UNDERRUN

[a] Use of headsaw with larger kerf than allowed for in the rule.

[b] Cutting of heavy slabs and not recovering any volume from these slabs.

[c] Cutting boards of heavy thickness, thus resulting in loss at planer.

[d] Cutting logs with excessive trim.

[e] Failure to recognize and allow for defects such as crooks and cracks when bucking and sawing.

21.16.3

LOG FORM [TAPER] INFLUENCE ON OVERRUN AND UNDERRUN

The actual volume of a log is dependent upon the log diameter, length, defect and form. Variations in log form is one of the most important factors that determine the amount of overrun that can be realized from a log. A log with considerable taper will usually give a much larger percentage of overrun than will a log that has very little taper.

A tree tapers from the stump to the top. The rate of taper is not uniform throughout all parts of the stem. Because of more rapid diameter growth the butt log usually has the greatest taper, followed closely by the top logs. The intermediate logs usually have the least taper.

As previously indicated the log rule allows for taper of 1/2 inch for each 4 feet of length. It has been shown that this is a conservative allowance for merchantable logs for all species so far studied in North America.

21.17

DERIVATION OF THE STANDARD RULE FOR DEDUCTIONS

The most accurate method of mathematically reducing the scale for interior defects showing in one or both ends of the log is to treat the defects as sawed out in squares or rectangles and apply the lumber formula $\left[\frac{W \times H \times L}{12}\right]$. However since the international 5/16th Inch Rule allows 5/16 inch for sawkerf plus 1/16 inch allowance for shrinkage, 27 percent of any square or rectangle inside the slab surfaces of the log is therefore, deducted in the rule.

Example:

1 board + kerf + shrinkage
16/16 in. + 5/16 in. + 1/16 in. = 22/16
Waste Percentage = $\frac{6}{22} \times 100 = 27$ percent

The substance of this method is to deduct 73 percent of the board foot contents of a piece of timber having the same dimensions as the defect.

Example:

$$\frac{W \times H \times L}{12} \times \frac{73}{100} = \frac{W \text{ in.} \times H \text{ in.} \times L \text{ ft.}}{16}$$

A slight allowance in excess of the dimensions bounding the actual defect is made to cover the loss in sound material. The incidental loss, which will ordinarily be taken to be 1 inch is added to the actual

diameter of the defect to give its total dimensions. The standard rule is thus:

$$\frac{[W + 1] \times [H + 1] \times L}{16}$$

21.18

INSTRUCTION FOR ALIGNMENT CHART

Instructions for using alignment chart for obtaining deductions for defect with International 5/16 Inch Log Rule.

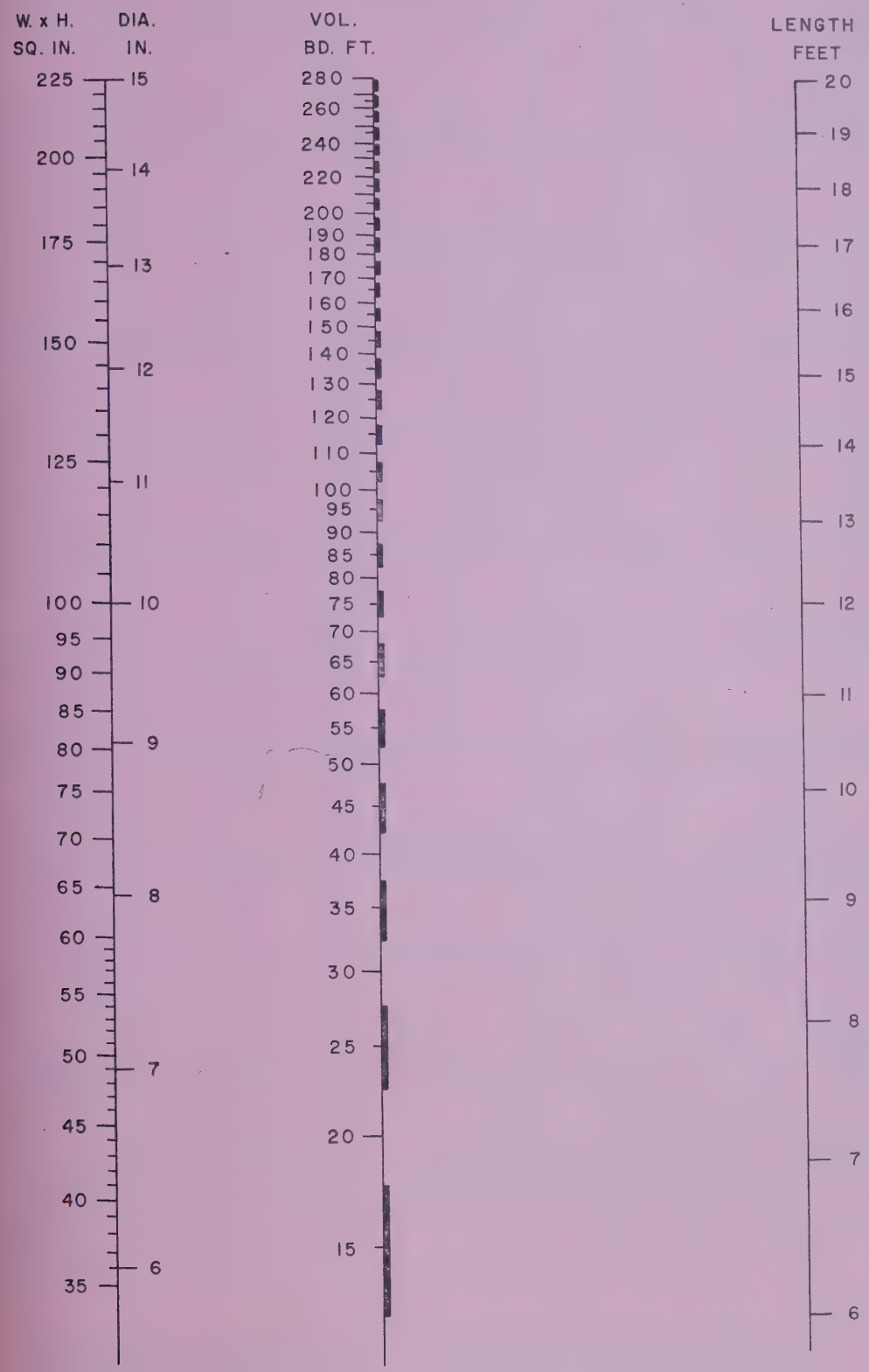
1. Measure width and height of defect in inches. Add 1 inch to each to allow for waste.
2. Multiply width by height.
3. Measure or estimate length of defect.
4. Place straight edge through product of W x H [left line] and length [right line].
5. Read deduction, to nearest 5 board feet, on centre line.

For example, if a defect measured 7 in. x 8 in. x 10 ft., the deduction would be determined by holding the straight edge through 72 on the left line [7 in. + 1] x [8 in. + 1] and 10 on the right line. The deduction, centre line intersection, is 45 board feet.

CHART FOR DETERMINING DEFECT ALLOWANCE

INTERNATIONAL 5/16 LOG RULE

Board feet = $\frac{\text{W in. x H in. x L ft.}}{16}$ or $\frac{[\text{D in.}]^2 \text{L ft.}}{16}$ [for Circular Defect]



INTERNATIONAL 5/16 INCH LOG RULE

GOVERNMENT OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

LENGTH IN FEET

DIAMETER IN INCHES INSIDE BARK AT SMALL END OF LOG

	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
5	3	3	4	5	6	6	7	8	9	10	11	13	14	15	16	5
6	5	6	7	9	10	11	12	14	15	17	18	20	22	24	26	6
7	8	10	11	13	15	17	18	21	23	25	27	30	32	35	37	7
8	12	14	16	19	21	24	26	29	32	35	37	41	44	47	50	8
9	16	19	21	25	28	31	34	38	42	46	49	53	57	61	65	9
10	20	24	27	31	35	40	44	49	53	58	62	67	72	77	82	10
11	25	30	34	39	44	49	54	60	65	71	76	82	88	94	100	11
12	31	37	42	48	54	60	66	73	80	87	93	100	107	114	121	12
13	37	44	51	58	65	72	79	87	95	102	110	119	127	136	144	13
14	45	53	60	69	77	85	93	101	111	120	129	139	149	159	168	14
15	52	61	70	80	90	100	109	120	130	140	150	161	172	183	195	15
16	60	70	80	92	103	114	125	137	149	161	172	185	198	211	223	16
17	69	81	92	105	118	131	143	157	170	183	196	211	225	239	253	17
18	78	91	104	119	133	147	161	176	191	207	222	238	254	270	285	18
19	87	102	117	133	149	165	181	198	215	232	248	266	284	302	319	19
20	98	115	131	149	167	185	202	221	240	259	277	297	316	336	355	20
21	109	128	146	166	185	205	224	245	266	287	307	329	350	372	393	21
22	120	141	161	183	204	226	247	270	293	316	338	362	386	410	433	22
23	132	155	177	201	225	249	272	297	322	347	371	397	423	449	474	23
24	145	170	194	220	246	272	297	324	351	378	405	434	462	490	518	24
25	157	185	211	240	268	296	324	354	383	412	441	472	502	533	563	25
26	171	201	230	261	291	322	352	384	416	448	479	512	545	578	610	26
27	186	218	249	282	315	348	381	416	450	484	518	554	589	625	660	27
28	201	235	269	305	340	376	411	448	485	522	558	597	635	673	711	28
29	216	253	289	328	366	404	442	482	521	561	600	641	682	723	764	29
30	232	272	311	352	393	434	474	517	559	602	644	688	732	776	819	30
31	248	291	333	377	420	464	508	553	598	644	689	736	782	829	876	31
32	265	311	356	403	449	496	543	591	639	687	735	785	834	885	934	32
33	283	332	380	430	479	529	578	630	681	732	783	836	889	942	995	33
34	301	353	404	457	509	563	615	670	724	779	833	889	945	1001	1057	34
35	320	375	429	486	541	598	653	711	768	827	884	944	1003	1063	1122	35
36	340	398	455	515	574	634	693	754	814	876	937	1000	1062	1125	1188	36
37	360	421	482	545	607	671	733	798	862	927	991	1058	1123	1190	1256	37
38	380	445	509	576	642	709	774	843	910	979	1047	1117	1186	1257	1326	38
39	401	470	537	608	677	748	817	889	960	1033	1104	1178	1251	1325	1398	39
40	423	495	566	641	713	788	861	937	1011	1088	1163	1240	1317	1395	1472	40
41	445	521	596	674	751	829	906	986	1064	1144	1223	1305	1385	1467	1548	41
42	468	548	627	709	789	871	952	1036	1118	1202	1285	1370	1455	1541	1626	42
43	491	575	658	744	828	914	999	1087	1173	1261	1348	1438	1526	1616	1705	43
44	515	604	690	780	868	959	1047	1139	1230	1322	1413	1507	1599	1694	1787	44
45	540	632	723	817	910	1004	1097	1193	1288	1384	1479	1577	1674	1773	1870	45
46	565	662	756	855	952	1050	1148	1248	1347	1448	1547	1650	1751	1854	1956	46
47	591	692	791	894	995	1098	1199	1304	1407	1513	1617	1724	1829	1937	2043	47
48	617	722	826	933	1039	1146	1252	1362	1469	1579	1688	1799	1909	2021	2132	48
49	644	754	861	974	1084	1196	1306	1420	1532	1647	1760	1876	1991	2108	2223	49
50	671	786	898	1015	1129	1246	1361	1480	1597	1716	1834	1955	2074	2196	2316	50
	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	

DIAMETER IN INCHES INSIDE BARK AT SMALL END OF LOG

NOTE: DIAMETER TO BE MEASURED TO THE NEAREST INCH INSIDE BARK AT SMALL END OF LOG. LOGS OVER TWENTY FEET IN LENGTH MUST BE SCALED AS TWO LOGS

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

FOREST MANAGEMENT

SCALING INSTRUCTIONS FOR STACKED PULPWOOD

CHAPTER 22

Revised - September 1960

CHAPTER 22

SCALING INSTRUCTIONS FOR STACKED PULPWOOD

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GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Revised, October, 1960 SCALING INSTRUCTIONS

22.1 Introduction Stacked Pulpwood

When scaling or measuring timber, a scaler is determining the amount of government property passing into private ownership and the amount of revenue payable to the Crown from the sale of that property. It is his duty, holding an Alberta scaling licence or permit and being responsible to the department, to determine these amounts fairly and accurately.

Scaling as practised in the province of Alberta shall be a measurement of solid material and relates to quantity rather than quality of that material. Pulpwood piles will therefore be scaled in accordance with the defect in the wood and not in relation to any particular grade of material they may contain. It is not the duty of a scaler to make adjustments.

The following is the basic procedure for scaling stacked pulpwood. However, where agreement stipulations appear in a contract between the department and a company they are to be co-ordinated with the basic procedure.

Where dues are paid according to the schedule for the general rate of dues, a break down is made into three classifications, namely pulpwood of poplar, pulpwood of other timber and pulpwood of other timber (firekilled).

By separate agreement between the Minister and a Company an over-all rate of dues may be decided upon.

By further agreement, a company may retain the option to waive the foregoing and pay the dues by species; the percentage of each species being determined from an approved cruise report.

A pulpwood bolt or log is considered to be a cull if more than 50% of its volume is defective. Sound dry timber is acceptable as pulpwood and also any tree authorized for cutting containing one stick of pulpwood must be cut.

22.2 Definitions and Contents of the Stacked Cord

(a) THE CORD is a unit for measuring the volume of wood that has been cut to certain uniform lengths and stacked into regular piles or ranks. Wood in the form of bolts or sticks intended for use as pulpwood is usually measured by the cord which is defined by Section 22A of the "Dominion Weights and Measures Act" passed May 25, 1935, as follows: "THE CORD shall contain one hundred and twenty-eight (128) cubic feet." (Fig. 1) Usually it is understood as a pile of wood 4' x 4' x 8' occupying 128 cubic feet of space. Pulpwood is cut in 4 ft. or 8 ft. bolts, the latter being the length most common to Alberta.

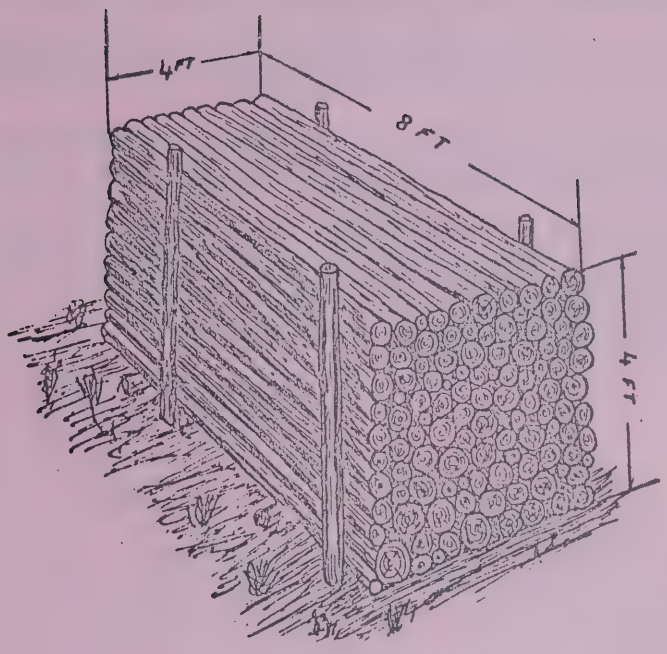


Fig. No. 1 - A LEGAL CORD

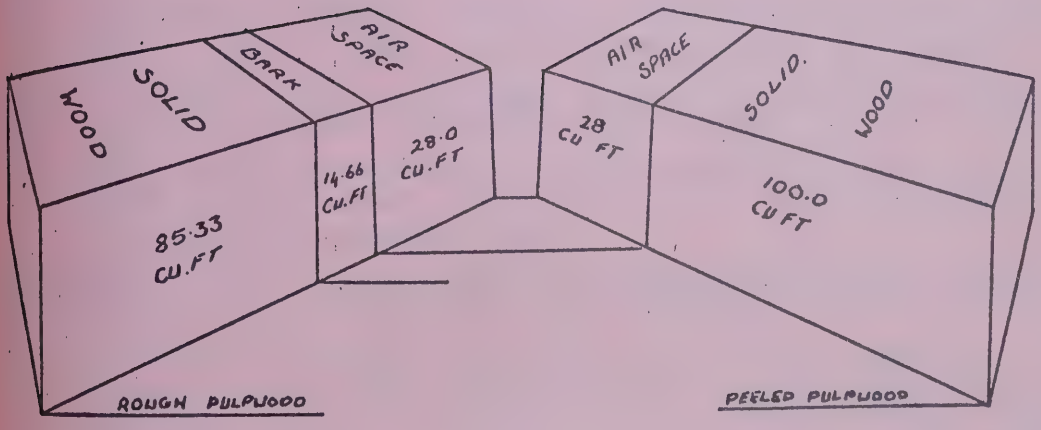


Fig. No. 2 - SOLID WOOD CONTENTS OF ROUGH AND PEELED PULPWOOD

(b) SOLID WOOD CONTENTS OF THE STACKED CORD

Although the stacked cord occupies a space of 128 cubic feet it is quite obvious that this is not all solid wood.

Certain portions of the pile will be occupied by air spaces between the bolts and also by the bark in the case of rough pulpwood.

The actual wood content of the cord may vary from 50 cubic ft. for small crooked wood to 100 cubic ft. for large uniform size pulpwood. However, from many tests it has been ascertained that a standard cord of 128 cubic ft. of rough pulpwood is made up of:

85.33 cubic feet of wood
14.67 cubic feet of bark
28.00 cubic feet of air space

Total 128.0 cubic feet

In sap-peeled pulpwood where the bark is absent, the solid wood content is increased by about 15% to 100 cu.ft. as the 14.67 cu. ft. of bark has now been replaced by solid wood. This 15% must be charged when assessing royalties for green sap-peeled pulpwood whereas no addition is made for firekilled pulpwood. (Fig.2) The general converting factor in use in Alberta is 450 f.b.m. per cord of rough pulpwood and 85 cu. ft. of solid wood per cord of rough wood.

22.3 FACTORS AFFECTING SOLID WOOD CONTENT OF PILES

Many factors influence the solid wood content of a stacked cord some of which are as follows:

(a) Species - Softwoods yield more solid wood per cord than hardwoods because of the greater smoothness and straighter form of the softwoods.

(b) Length of stick - The longer the bolt the less solid wood per cord as they do not pack as closely as short lengths.

(c) Diameter of the sticks - With large diameters there is less air space therefore more solid wood per cord. An increase in the number of bolts increases the air space.

(d) Peeled or rough - as previously shown the average content of bark in a cord of rough pulpwood is 14.67 cubic feet.

(e) Method of piling - The way the wood is piled is one of the most important factors influencing the yield per cord in solid wood. Bolts that are square piled (Fig. 3A) increase the air space whereas piling in a hexagonal formation (Fig 3B) will reduce the air space by as much as 10% in comparison.

(f) Limbs and knots - Limbs and knots left on pulpwood bolts prevent even piling causing unnecessary air spaces and voids.

22.4 INSTRUCTIONS CONCERNING THE PILING OF PULPWOOD TO BE SCALED

(1) All logs shall be piled on skids of non-merchantable material so as to be off the ground and beyond the reach of rising water.

(2) The immediate surrounding of each pile must be cleared and a lane of at least 4 feet left between piles.

(3) Pulpwood shall not be piled against standing trees.

(4) Piles should be so made as to present one even vertical face and contain only bolts of the same length.

(5) The bottoms of each pile should be as level and as horizontal as possible.

(6) No reduction of the apparent volume is permitted for faulty piling. If the scaler or forest officer feels that the woods worker has stacked his wood poorly he may refuse to scale it and the wood shall be restacked for scaling within the period specified by the scaler or forest officer.

(7) The heights and lengths of the piles shall be reported in feet and tenths of a foot. Lengths of bolts where necessary will be reported in inches (not feet).

(8) Bolts and logs shall be trimmed of all limbs, knots and burls evenly with the body of the bolt or log.

(9) All pulpwood bolts must be sawn square at both ends.

(10) Crooked bolts and doubtful cull bolts should be placed on top of the pile.

22.5 METHOD OF SCALING

Using a tape to measure the length and a scaling stick (Fig. 4) both graduated in tenths of a foot, the scaler measures the height and length of each pile. The length of several bolts should also be measured as check against over-length. The heights and lengths are measured from one side of the pile only as it is assumed that there is an equal distribution of butts, tops, defects, culls and voids on both sides. Defects are considered as extending through the full length of the bolt.

If it appears that one side of a row of piles has a predominance of butts, defects or voids, it should be scaled on alternate sides from one pile to the other so as to obtain a fair scale.

Each pile shall be stamped or marked and shall display the road number, pile number and the scaler's initials. Piles shall be numbered consecutively from 1 - 10,000 and then prefixed by a letter, e.g. A1 - A10,000.

The Alberta Forest Service reserves for its own exclusive use red crayon and no unauthorized person shall use this color for marking and scaling on any logs or bolts.

It is necessary that all check scaling be done on the same side as the original scale. Where a check scaler finds a discrepancy in the original scale that does not fall within the prescribed margin allowance set down by the department, a written report shall be submitted immediately to the divisional office along with a copy for the District Forest Officer.

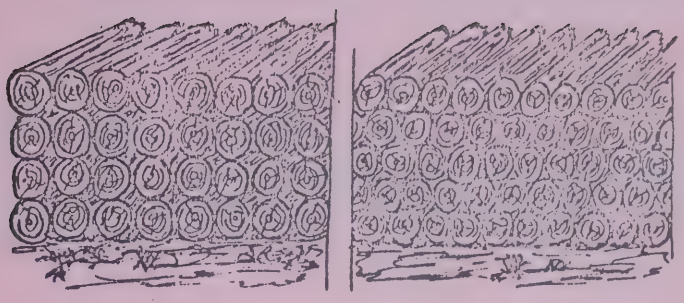


Fig. No. 3 - SQUARE AND HEXAGONAL PILING

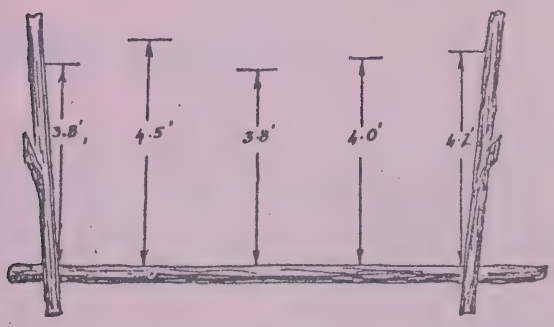


Fig. No. 5 - HEIGHT MEASUREMENTS

$$\frac{3.8 + 4.5 + 3.8 + 4.0 + 4.2}{5} = 4.1'$$

Alternative Method: - $\frac{.2}{1} + \frac{.3}{2} + \frac{.1}{3} + \frac{.1}{4} + \frac{.3}{5} = + .06 = 4.1$

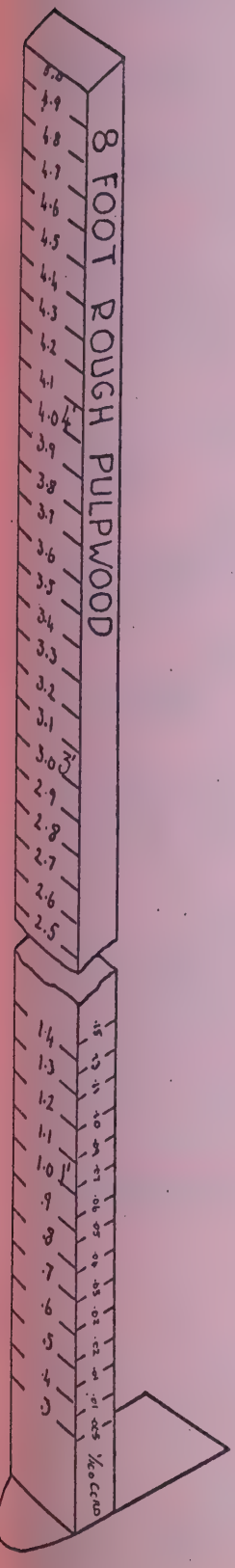


Fig. No. 4 - 8 FOOT ROUGH PULPWOOD SCALING STICK

A. DIMENSIONS

The height and length of the pile are measured in feet and tenths of feet. Height and length measurements must perpendicular to each other.

B. HEIGHT

Height measurements on a pile stacked wood should be taken at regular intervals of not more than 5 feet along the pile and an average of the measurements recorded. The more uneven the pile the more measurements should be taken so as to arrive at a fair average. (Fig. 5)

C. LENGTH

The average length of the pile is taken with the aid of a tape allowing for the slope generally found at the ends of a pile. (Fig. 6A and B)

Where wood is piled on a slope, the height measurements are taken perpendicular to and the length parallel to a line through the base of the pile. (Fig. 6C).

Bolts should be sawn square at both ends.

D. WIDTH

The width of the pile or length of the bolts should be measured. Stacked wood generally contains 4 foot or 8 foot bolts, the latter being by far the most common in Alberta. Pulpwood over 8 ft. in length MAY be scaled by the piece using the ALBERTA CUBIC FOOT SCALE.

An allowance of one inch in two feet for "broomage" on all pulpwood bolts is made to compensate damage to the ends, thus a four foot bolt is legally cut at fifty inches and an eight foot bolt cut at one hundred inches. Where bolts are found to have been cut longer than the length allowed for broomage a percentage of the total cordage in the pile is added for each inch of over-length. (See Table 22.10.5 and Table 22.10.6) Bolts cut under the prescribed lengths of 48" or 96" will be considered as full length bolts and no deduction will be allowed.

N.B. Settling - The practice of deducting 0.2 ft. from the average height of a pile to compensate for settling of stacked wood 50" high is not acceptable to the department. This deduction amounts to 5% of the actual wood contents in the pile of cordwood.

22.5.1 STACKED CONTENTS

Having measured the height and length of the pile, we now wish to know its cubic contents so as to arrive at the number of cords it contains.

The first step is to multiply the height and the length of the pile to find the area of the face in square feet. This, in turn is multiplied by the width (length of bolts in feet) to establish the cubic ft. content of the pile.

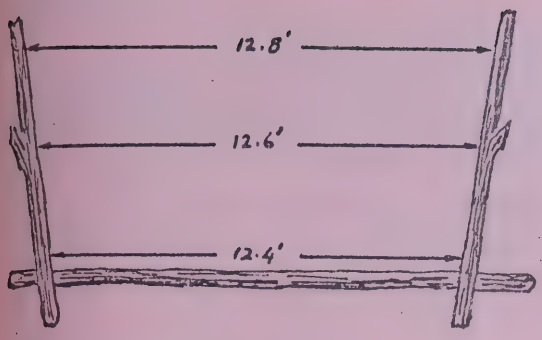
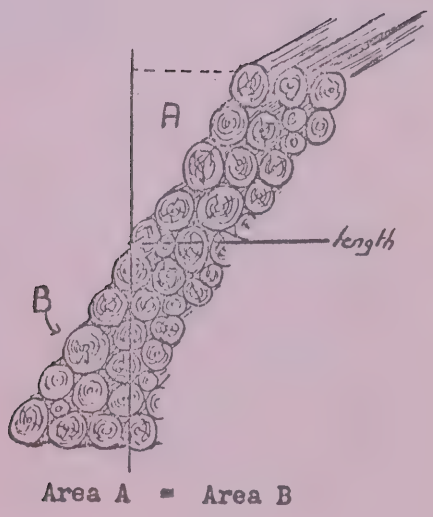


Fig. No. 6 (A) - LENGTH MEASUREMENTS

$$\frac{12.8 + 12.6 + 12.4}{3} = 12.6'$$

Fig. No. 6 (B) - LENGTH MEASUREMENTS



Area A = Area B

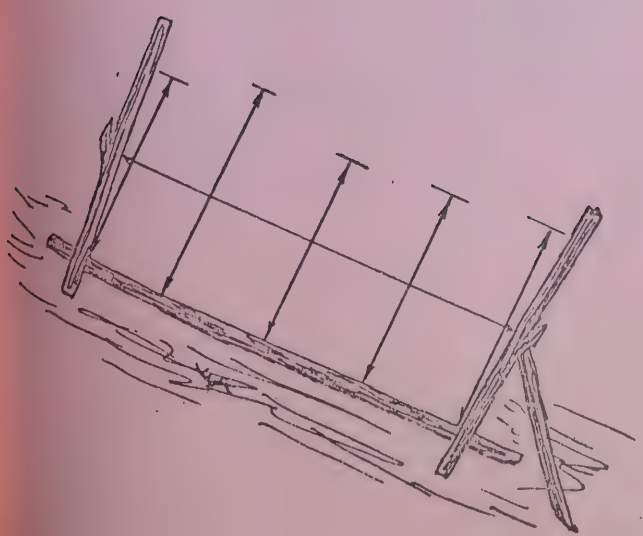


Fig. No. 6 (C) - LENGTH MEASUREMENTS

The cubic foot content is then divided by 128 cubic feet (legal cord) to give the number of cords in the pile. To simplify the foregoing, the face area may be divided by 32 for 4 foot bolts (128 ÷ 4 = 32) or by 16 for 8 foot bolts (128 ÷ 8 = 16) to obtain the same results.

EXAMPLE

8 foot pulpwood is stacked in a pile 7.2 feet long and 4.2 feet high. The area of the face would be 7.2 x 4.2 or 30.24 square feet and the pile would occupy a space of 30.24 x 8' or 241.92 cubic feet, therefore the number of cords would be 241.92 ÷ 128 or 1.89 cords.

As explained previously, a short cut would be to divide the face area by 16 as follows: - 30.24 ÷ 16 = 1.89 cords.

The use of an authorized conversion chart is permissible.

22.6 DEFECTS

Where an apparent defect is observed on the end of a bolt, it is assumed that it extends the full length of the bolt and deductions are made accordingly.

NO DEDUCTIONS ARE MADE FOR DEFECTS TWO INCHES IN DIAMETER OR LESS.

NO DEDUCTIONS ARE MADE FOR STAIN OR DISCOLORATION. "Buttermilk" rot is deductable although the stages of the disease leading up to this condition are not deductable. Deductions for a few of the common types of defects are as follows:

Circular Defect (Fig. 7A)

One side of the 8 foot rough pulpwood scale stick is graduated in 100th of cord per inch. (or see Table No. 1 for the contents of a pulpwood bolt by diameter in stacked cords). The scaling stick is placed on the circular defect and its contents recorded in hundredths of a cord. i.e. Defect - .01 cords.

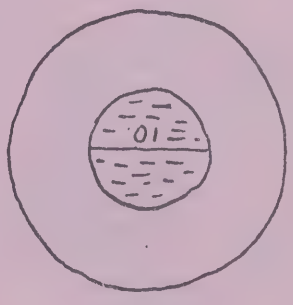


Fig. 7A

Defective Ring (Fig. 7B)

Measure contents of the total log and subtract contents of the sound portion i.e. Bolt - .07 cords Sound portion - .05 cord. Defect = .07 - .05 or .02 deduction.

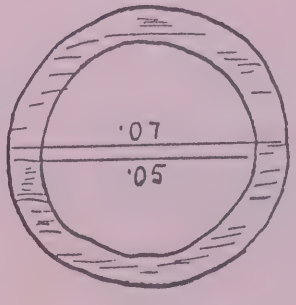
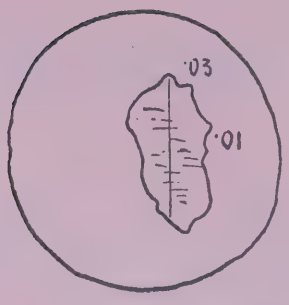


Fig. 7B

Irregular Shaped Defect-(Fig. 7C)



Tally deduction for average contents e.g. $\frac{.01 + .03}{2}$ = .02 cords

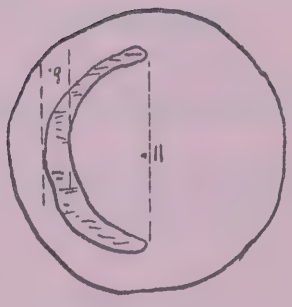
Fig. 7C

Distributed defects (Fig. 7D)

Total contents of defects e.g. ,01 + .03 + .02 = .06 cords

Fig. 7D

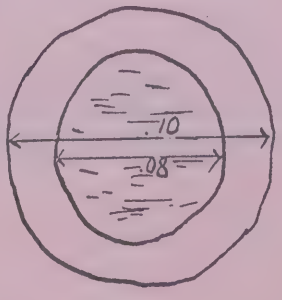
Crescent Shaped Defect (Fig. 7E)



Where a crescent shaped defect is not more than an inch wide scale the contents of the diameter and divide by 9. e.g. Contents as per diameter = .11. Contents as per crescent = $\frac{.11}{9}$ = .01 cords.

Fig. 7E

Culls (Fig. 7F)



A pulpwood bolt is considered a cull when more than 50% of its volume is defective.

The method of determining culls is to square the diameter of the defect and if it is more than half the square of the diameter of the bolt it must be culled. e.g.
Diameter of Bolt squared = 10 x 10 = 100
Diameter of Defect squared = 8 x 8 = 64 as 64 is more than half a 100 the bolt is considered cull.

Fig. 7F

Further to the above, culls may also be measured by using the scale graduated in 1/100ths of a cord. e.g.

Diameter of bolt = .05 cords
Diameter of defect = .03 cords

as the volume of the defect is greater than 50% the bolt is a cull.

For a rule of thumb to follow see Table No. 2. Discoloration and stain are not deductible although Buttermilk is deductible.

22.7 VOIDS

A void can be defined as an unnecessary air space left in a pile of stacked wood in which a bolt of average diameter will easily fit. The average area of void is measured and recorded in hundredths of a cord. (See Fig. 8). In extra large voids the volume of the estimated number of sticks required to fill the void are recorded.

22.8 Field Procedure

The best procedure when scaling stacked piles is to collect the data in the same sequence as it appears on the tally card, see Fig. 10. First the pile is clearly marked with the road or strip number, the number of the pile, marked in sequence along the road or strip and the scalers initials. These numbers are than recorded on the tally card. (See Fig. 10). Next the length and height measurements are taken as per the paragraph on dimensions and entered on the tally card. The actual calculation of the gross cords in the pile can be left until the end of the day and calculated with the aid of table No. 3. Having taken the dimensions of the pile the next step is to look for culls, defects and voids which are recorded in the space provided on the tally card. At least a double line shall be marked with the letter "S" or stamped on the end of the bolts ranging from top to bottom in a vertical plane near both ends of the pile. (Fig. No. 9)

All culls in a pile will be designated by an "X" written across the end of the bolt.

A ring will be drawn around or beside all defects for which deductions have been made.

When looking for voids, first estimate the average diameter of bolts in the pile then any void equal to or larger than that measurement may be recorded as a void.

When the deductions have been entered, check the tally card to insure that all the measurements are complete. At the end of the day, the gross total of cords scaled will be calculated and the total deductions subtracted giving the net cords tallied. All the information taken on the tally cards is transferred DAILY to an authorized Scaling Journal.

Where pulpwood is cut in tree lengths, the final scale may be made after it has been slashed into 100" lengths. The stacked cord measurement is used, the wood being scaled either on the ground or on the truck.

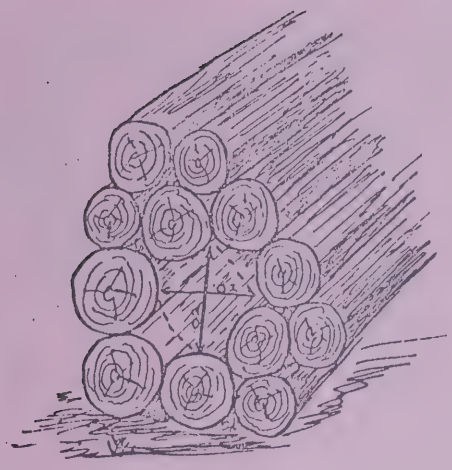


FIG NO 8 A VOID.

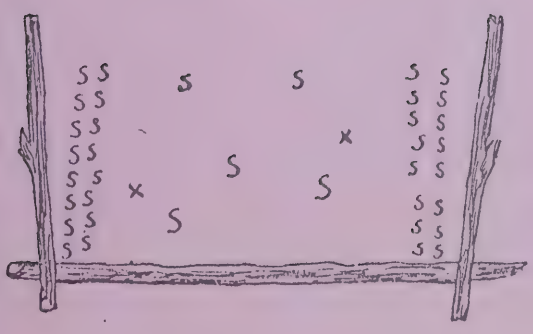


FIG NO 9 MARKING PULPWOOD PILES.

Tally No.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

Form FM 82 (505)

License, Permit or Lease_____

Contractor_____ For_____

Camp No._____

Date _____ 19____

Man Unit or W.C._____

Forest Division _____

SCALE TALLY

4ft or 8ft Rough or Peeled Stacked Wood

SCALE																													
RD. NO.	PILE NO.	DIMENSIONS				GROSS CORDS		DEDUCTIONS						RD. NO.	PILE NO.	DIMENSIONS				GROSS CORDS		DEDUCTIONS					
		Length		Height				C.F. CULLS		C.F. DEF'TS		C.F. VOIDS				Length		Height				C.F. CULLS		C.F. DEF'TS		VOIDS	

22.9 EQUIPMENT FOR SCALING PULPWOOD

(1) Steel tape (graduated in tenths of a foot)

(2) 8 ft. rough pulpwood scaling stick approved by A.F.S.

(3) Truck rough pulpwood scaling stick approved by A.F.S.

(4) Pulpwood tally card holder

(5) Lumber crayon and pencil holder

(6) Lumber crayon and/or stamping axe

(7) 2H pencils

(8) Forest type map and/or cut lay out map (4" to 1 mile)

(9) Scaling tally cards (Form No. FM 82 (505))

(10) Compilation tables

(11) Departmental scaling instructions

(12) Stationery, stamps, carbon paper, etc.

(Equipment to be supplied by lessee, licensee or permittee)

22.10 TABLES

22.10.1 TABLE SHOWING CONTENTS OF PULPWOOD BOLTS BY DIAMETER IN STACKED CORDS OF 128 CU. FT.

Applicable only to stacked 8-foot rough pulpwood

Formula = Cords $\frac{D^2 \times .7854 \times 8 \times 1.50 / 128}{144} = D^2 \times .00051133$

Diameter of bolt in inches	Number of pieces 1	2	3	4	5	6	7	8	9	10
	Contents in stacked cords									
3	.005	.010	.015	.020	.025	.030	.035	.040	.045	.050
4	.008	.016	.024	.032	.040	.048	.056	.064	.072	.080
5	.013	.026	.039	.052	.065	.078	.091	.104	.117	.130
6	.018	.036	.054	.072	.090	.108	.126	.144	.162	.180
7	.025	.050	.075	.100	.125	.150	.175	.200	.225	.250
8	.033	.066	.099	.132	.165	.198	.231	.264	.297	.330
9	.041	.082	.123	.164	.205	.246	.287	.328	.369	.410
10	.051	.102	.153	.204	.255	.306	.357	.408	.459	.510
11	.062	.124	.186	.248	.310	.372	.434	.496	.558	.620
12	.074	.148	.222	.296	.370	.444	.518	.592	.666	.740
13	.086	.172	.258	.344	.430	.516	.602	.688	.774	.860
14	.100	.200	.300	.400	.500	.600	.700	.800	.900	1.000
15	.115	.230	.345	.460	.575	.690	.805	.920	1.035	1.150
16	.131	.262	.393	.524	.655	.786	.917	1.048	1.179	1.310
17	.147	.294	.441	.588	.735	.882	1.029	1.176	1.323	1.470
18	.166	.332	.498	.664	.830	.996	1.162	1.328	1.494	1.660
19	.184	.368	.552	.736	.920	1.104	1.288	1.472	1.656	1.840
20	.204	.408	.612	.816	1,020	1.224	1.428	1.632	1.836	2.040

10.2 TABLE NO. 2 SHOWING DIAMETER OF DEFECT REQUIRED TO CULL PULPWOOD OF VARIOUS DIAMETERS

Applicable to all Pulpwood of Any Length

Diameter of Log	Diameter of Defect
4 inches	3 inches
5 inches	4 inches
6 inches	5 inches
7 inches	5 inches
8 inches	6 inches
9 inches	7 inches
10 inches	8 inches
11 inches	8 inches
12 inches	9 inches
13 inches	10 inches
14 inches	10 inches
15 inches	11 inches
16 inches	12 inches
17 inches	13 inches
18 inches	13 inches
19 inches	14 inches
20 inches	15 inches
21 inches	15 inches
22 inches	16 inches
23 inches	17 inches
24 inches	17 inches
25 inches	18 inches

2.10.3 COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 1

20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	
.25	.26	.27	.29	.30	.31	.32	.34	.35	.36	.37	.39	.40	.41	.42	.44	.45	.46	.47	20
.26	.27	.29	.30	.31	.33	.34	.35	.37	.38	.39	.41	.42	.43	.45	.46	.47	.49	.50	21
.27	.29	.30	.32	.33	.34	.36	.37	.38	.40	.41	.43	.44	.45	.47	.48	.49	.51	.52	22
.29	.30	.32	.33	.34	.36	.37	.39	.40	.42	.43	.45	.46	.47	.49	.50	.52	.53	.55	23
.30	.31	.33	.34	.36	.37	.39	.40	.42	.43	.45	.46	.48	.49	.51	.52	.54	.55	.57	24
.31	.33	.34	.36	.37	.39	.41	.42	.44	.45	.47	.48	.50	.52	.53	.55	.56	.58	.59	25
.32	.34	.36	.37	.39	.41	.42	.44	.45	.47	.49	.50	.52	.54	.55	.57	.58	.60	.62	26
.34	.35	.37	.39	.40	.42	.44	.46	.47	.49	.51	.52	.54	.56	.57	.59	.61	.62	.64	27
.35	.37	.38	.40	.42	.44	.45	.47	.49	.51	.52	.54	.56	.58	.59	.61	.63	.65	.66	28
.36	.38	.40	.42	.43	.45	.47	.49	.51	.53	.54	.56	.58	.60	.62	.63	.65	.67	.69	29
.37	.39	.41	.43	.45	.47	.49	.51	.52	.54	.56	.58	.60	.62	.64	.66	.67	.69	.71	30
.39	.41	.43	.45	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70	.72	.74	31
.40	.42	.44	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70	.72	.74	.76	32
.41	.43	.45	.47	.49	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70	.72	.74	.76	.78	33
.42	.45	.47	.49	.51	.53	.55	.57	.59	.62	.64	.66	.68	.70	.72	.74	.76	.79	.81	34
.44	.46	.48	.50	.52	.55	.57	.59	.61	.63	.66	.68	.70	.72	.74	.77	.79	.81	.83	35
.45	.47	.49	.52	.54	.56	.58	.61	.63	.65	.67	.70	.72	.74	.76	.79	.81	.83	.85	36
.46	.49	.51	.53	.55	.58	.60	.62	.65	.67	.69	.72	.74	.76	.79	.81	.83	.86	.88	37
.47	.50	.52	.55	.57	.59	.62	.64	.66	.69	.71	.74	.76	.78	.81	.83	.85	.88	.90	38
.49	.51	.54	.56	.58	.61	.63	.66	.68	.71	.73	.76	.78	.80	.83	.85	.88	.90	.93	39
.50	.52	.55	.57	.60	.62	.65	.67	.70	.72	.75	.77	.80	.82	.85	.87	.90	.92	.95	40
.51	.54	.56	.59	.61	.64	.67	.69	.72	.74	.77	.79	.82	.84	.87	.90	.92	.95	.97	41
.52	.55	.58	.60	.63	.66	.68	.71	.73	.76	.79	.81	.84	.87	.89	.92	.94	.97	1.00	42
.54	.56	.59	.62	.64	.67	.70	.73	.75	.78	.81	.83	.86	.89	.91	.94	.97	.99	1.02	43
.55	.58	.60	.63	.66	.69	.71	.74	.77	.80	.82	.85	.88	.91	.93	.96	.99	1.02	1.04	44
.56	.59	.62	.65	.67	.70	.73	.76	.79	.82	.84	.87	.90	.93	.96	.98	1.01	1.04	1.07	45
.57	.60	.63	.66	.69	.72	.75	.78	.80	.83	.86	.89	.92	.95	.98	1.01	1.03	1.06	1.09	46
.59	.62	.65	.68	.70	.73	.76	.79	.82	.85	.88	.91	.94	.97	1.00	1.03	1.06	1.09	1.12	47
.60	.63	.66	.69	.72	.75	.78	.81	.84	.87	.90	.93	.96	.99	1.02	1.05	1.08	1.11	1.14	48
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 2

39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	
.49	.50	.51	.52	.54	.55	.56	.57	.59	.60	.61	.62	.64	.65	.66	.67	.69	20
.51	.52	.54	.55	.56	.58	.59	.60	.62	.63	.64	.66	.67	.68	.70	.71	.72	21
.54	.55	.56	.58	.59	.60	.62	.63	.65	.66	.67	.69	.70	.71	.73	.74	.76	22
.56	.57	.59	.60	.62	.63	.65	.66	.68	.69	.70	.72	.73	.75	.76	.78	.79	23
.58	.60	.61	.63	.64	.66	.67	.69	.70	.72	.73	.75	.76	.78	.79	.81	.82	24
.61	.62	.64	.66	.67	.69	.70	.72	.73	.75	.77	.78	.80	.81	.83	.84	.86	25
.63	.65	.67	.68	.70	.71	.73	.75	.76	.78	.80	.81	.83	.84	.86	.88	.89	26
.66	.67	.69	.71	.73	.74	.76	.78	.79	.81	.83	.84	.86	.88	.89	.91	.93	27
.68	.70	.72	.73	.75	.77	.79	.80	.82	.84	.86	.87	.89	.91	.93	.94	.96	28
.71	.72	.74	.76	.78	.80	.82	.83	.85	.87	.89	.91	.92	.94	.96	.98	1.00	29
.73	.75	.77	.79	.81	.82	.84	.86	.88	.90	.92	.94	.96	.97	.99	1.01	1.03	30
.76	.77	.79	.81	.83	.85	.87	.89	.91	.93	.95	.97	.99	1.01	1.03	1.05	1.07	31
.78	.80	.82	.84	.86	.88	.90	.92	.94	.96	.98	1.00	1.02	1.04	1.06	1.08	1.10	32
.80	.82	.85	.87	.89	.91	.93	.95	.97	.99	1.01	1.03	1.05	1.07	1.09	1.11	1.13	33
.83	.85	.87	.89	.91	.93	.96	.98	1.00	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17	34
.85	.87	.90	.92	.94	.96	.98	1.01	1.03	1.05	1.07	1.09	1.12	1.14	1.16	1.18	1.20	35
.88	.90	.92	.94	.97	.99	1.01	1.03	1.06	1.08	1.10	1.12	1.15	1.17	1.19	1.21	1.24	36
.90	.92	.95	.97	.99	1.02	1.04	1.06	1.09	1.11	1.13	1.16	1.18	1.20	1.23	1.25	1.27	37
.93	.95	.97	1.00	1.02	1.04	1.07	1.09	1.12	1.14	1.16	1.19	1.21	1.23	1.26	1.28	1.30	38
.95	.97	1.00	1.02	1.05	1.07	1.10	1.12	1.15	1.17	1.20	1.22	1.24	1.27	1.29	1.32	1.34	39
.97	1.00	1.02	1.05	1.07	1.10	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30	1.32	1.35	1.37	40
1.00	1.02	1.05	1.08	1.10	1.13	1.15	1.18	1.20	1.23	1.26	1.28	1.31	1.33	1.36	1.38	1.41	41
1.02	1.05	1.08	1.10	1.13	1.15	1.18	1.21	1.23	1.26	1.29	1.31	1.34	1.36	1.39	1.42	1.44	42
1.05	1.07	1.10	1.13	1.16	1.18	1.21	1.24	1.26	1.29	1.32	1.34	1.37	1.40	1.42	1.45	1.48	43
1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.26	1.29	1.32	1.35	1.37	1.40	1.43	1.46	1.48	1.51	44
1.10	1.12	1.15	1.18	1.21	1.24	1.27	1.29	1.32	1.35	1.38	1.41	1.43	1.46	1.49	1.52	1.55	45
1.12	1.15	1.18	1.21	1.24	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.49	1.52	1.55	1.58	46
1.15	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56	1.59	1.62	47
1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56	1.59	1.62	1.65	48
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 3

56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	
.70	.71	.72	.74	.75	.76	.77	.79	.80	.81	.82	.84	.85	.86	.87	.89	.90	.91	20
.73	.75	.76	.77	.79	.80	.81	.83	.84	.85	.87	.88	.89	.91	.92	.93	.94	.96	21
.77	.78	.80	.81	.82	.84	.85	.87	.88	.89	.91	.92	.93	.95	.96	.98	.99	1.00	22
.80	.82	.83	.85	.86	.88	.89	.91	.92	.93	.95	.96	.98	.99	1.01	1.02	1.03	1.05	23
.84	.85	.87	.88	.90	.91	.93	.94	.96	.97	.99	1.00	1.02	1.03	1.05	1.06	1.08	1.09	24
.87	.89	.91	.92	.94	.95	.97	.98	1.00	1.02	1.03	1.05	1.06	1.08	1.09	1.11	1.12	1.14	25
.91	.93	.94	.96	.97	.99	1.01	1.02	1.04	1.06	1.07	1.09	1.10	1.12	1.14	1.15	1.17	1.19	26
.94	.96	.98	1.00	1.01	1.03	1.05	1.06	1.08	1.10	1.11	1.13	1.15	1.16	1.18	1.20	1.21	1.23	27
.98	1.00	1.01	1.03	1.05	1.07	1.08	1.10	1.12	1.14	1.15	1.17	1.19	1.21	1.22	1.24	1.26	1.28	28
1.01	1.03	1.05	1.07	1.09	1.11	1.12	1.14	1.16	1.18	1.20	1.21	1.23	1.25	1.27	1.29	1.30	1.32	29
1.05	1.07	1.09	1.11	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.27	1.29	1.31	1.33	1.35	1.37	30
1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.39	1.41	31
1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.46	32
1.15	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.46	1.48	1.51	33
1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.47	1.49	1.51	1.53	1.55	34
1.22	1.25	1.27	1.29	1.31	1.33	1.36	1.38	1.40	1.42	1.44	1.47	1.49	1.51	1.53	1.55	1.57	1.60	35
1.26	1.28	1.30	1.33	1.35	1.37	1.39	1.42	1.44	1.46	1.48	1.51	1.53	1.55	1.57	1.60	1.62	1.64	36
1.29	1.32	1.34	1.36	1.39	1.41	1.43	1.46	1.48	1.50	1.53	1.55	1.57	1.60	1.62	1.64	1.66	1.69	37
1.33	1.35	1.38	1.40	1.42	1.45	1.47	1.50	1.52	1.54	1.57	1.59	1.61	1.64	1.66	1.69	1.71	1.73	38
1.36	1.39	1.41	1.44	1.46	1.49	1.51	1.54	1.56	1.58	1.61	1.63	1.66	1.68	1.71	1.73	1.75	1.78	39
1.40	1.42	1.45	1.47	1.50	1.52	1.55	1.57	1.60	1.62	1.65	1.67	1.70	1.72	1.75	1.77	1.80	1.82	40
1.43	1.46	1.49	1.51	1.54	1.56	1.59	1.61	1.64	1.66	1.69	1.72	1.74	1.77	1.79	1.82	1.84	1.87	41
1.47	1.50	1.52	1.55	1.57	1.60	1.63	1.65	1.68	1.71	1.73	1.76	1.78	1.81	1.84	1.86	1.89	1.92	42
1.50	1.53	1.56	1.59	1.61	1.64	1.67	1.69	1.72	1.75	1.77	1.80	1.83	1.85	1.88	1.91	1.93	1.96	43
1.54	1.57	1.59	1.62	1.65	1.68	1.70	1.73	1.76	1.79	1.81	1.84	1.87	1.90	1.92	1.95	1.98	2.01	44
1.57	1.60	1.63	1.66	1.69	1.72	1.74	1.77	1.80	1.83	1.86	1.88	1.91	1.94	1.97	2.00	2.02	2.05	45
1.61	1.64	1.67	1.70	1.72	1.75	1.78	1.81	1.84	1.87	1.90	1.93	1.95	1.98	2.01	2.04	2.07	2.10	46
1.64	1.67	1.70	1.73	1.76	1.79	1.82	1.85	1.88	1.91	1.94	1.97	2.00	2.03	2.06	2.09	2.11	2.14	47
1.68	1.71	1.74	1.77	1.80	1.83	1.86	1.89	1.92	1.95	1.98	2.01	2.04	2.07	2.10	2.13	2.16	2.19	48
56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 4

74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	
.92	.94	.95	.96	.97	.99	1.00	1.01	1.02	1.04	1.05	1.06	1.07	1.09	1.10	1.11	1.12	1.14	20
.97	.99	1.00	1.01	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.12	1.13	1.14	1.15	1.17	1.18	1.19	21
1.02	1.03	1.04	1.06	1.07	1.09	1.10	1.11	1.13	1.14	1.15	1.17	1.18	1.20	1.21	1.22	1.24	1.25	22
1.06	1.08	1.09	1.11	1.12	1.14	1.15	1.16	1.18	1.19	1.21	1.22	1.24	1.25	1.26	1.28	1.29	1.31	23
1.11	1.12	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.27	1.29	1.30	1.32	1.33	1.35	1.36	24
1.16	1.17	1.19	1.20	1.22	1.23	1.25	1.27	1.28	1.30	1.31	1.33	1.34	1.36	1.37	1.39	1.41	1.42	25
1.20	1.22	1.23	1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.36	1.38	1.39	1.41	1.43	1.45	1.46	1.48	26
1.25	1.27	1.28	1.30	1.32	1.33	1.35	1.37	1.38	1.40	1.42	1.43	1.45	1.47	1.48	1.50	1.52	1.54	27
1.29	1.31	1.33	1.35	1.36	1.38	1.40	1.42	1.43	1.45	1.47	1.49	1.50	1.52	1.54	1.56	1.57	1.59	28
1.34	1.36	1.38	1.40	1.41	1.43	1.45	1.47	1.49	1.50	1.52	1.54	1.56	1.58	1.59	1.61	1.63	1.65	29
1.39	1.41	1.42	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.57	1.59	1.61	1.63	1.65	1.67	1.69	1.71	30
1.43	1.45	1.47	1.49	1.51	1.53	1.55	1.57	1.59	1.61	1.63	1.65	1.67	1.69	1.70	1.72	1.74	1.76	31
1.48	1.50	1.52	1.54	1.56	1.58	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.76	1.78	1.80	1.82	32
1.53	1.55	1.57	1.59	1.61	1.63	1.65	1.67	1.69	1.71	1.73	1.75	1.77	1.79	1.81	1.84	1.86	1.88	33
1.57	1.59	1.61	1.64	1.66	1.68	1.70	1.72	1.74	1.76	1.78	1.81	1.83	1.85	1.87	1.89	1.91	1.93	34
1.62	1.64	1.66	1.68	1.71	1.73	1.75	1.77	1.79	1.82	1.84	1.86	1.88	1.90	1.92	1.95	1.97	1.99	35
1.66	1.69	1.71	1.73	1.75	1.78	1.80	1.82	1.84	1.87	1.89	1.91	1.93	1.96	1.98	2.00	2.02	2.05	36
1.71	1.73	1.76	1.78	1.80	1.83	1.85	1.87	1.90	1.92	1.94	1.97	1.99	2.01	2.03	2.06	2.08	2.10	37
1.76	1.78	1.80	1.83	1.85	1.88	1.90	1.92	1.95	1.97	1.99	2.02	2.04	2.06	2.09	2.11	2.14	2.16	38
1.80	1.83	1.85	1.88	1.90	1.93	1.95	1.97	2.00	2.02	2.05	2.07	2.10	2.12	2.14	2.17	2.19	2.22	39
1.85	1.87	1.90	1.92	1.95	1.97	2.00	2.02	2.05	2.07	2.10	2.12	2.15	2.17	2.20	2.22	2.25	2.27	40
1.89	1.92	1.95	1.97	2.00	2.02	2.05	2.08	2.10	2.13	2.15	2.18	2.20	2.23	2.25	2.28	2.31	2.33	41
1.94	1.97	1.99	2.02	2.05	2.07	2.10	2.12	2.15	2.18	2.20	2.23	2.26	2.28	2.31	2.34	2.36	2.39	42
1.99	2.02	2.04	2.07	2.10	2.12	2.15	2.18	2.20	2.23	2.26	2.28	2.31	2.34	2.36	2.39	2.42	2.45	43
2.03	2.06	2.09	2.12	2.14	2.17	2.20	2.23	2.25	2.28	2.31	2.34	2.36	2.39	2.42	2.45	2.47	2.50	44
2.08	2.11	2.14	2.17	2.19	2.22	2.25	2.28	2.31	2.33	2.36	2.39	2.42	2.45	2.47	2.50	2.53	2.56	45
2.13	2.16	2.18	2.21	2.24	2.27	2.30	2.33	2.36	2.39	2.41	2.44	2.47	2.50	2.53	2.56	2.59	2.62	46
2.17	2.20	2.23	2.26	2.29	2.32	2.35	2.38	2.41	2.44	2.47	2.50	2.53	2.56	2.58	2.61	2.64	2.67	47
2.22	2.25	2.28	2.31	2.34	2.37	2.40	2.43	2.46	2.49	2.52	2.55	2.58	2.61	2.64	2.67	2.70	2.73	48
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 5

92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	
15	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.27	1.29	1.30	1.31	1.32	1.34	1.35	1.36	20
21	1.22	1.23	1.25	1.26	1.27	1.29	1.30	1.31	1.33	1.34	1.35	1.36	1.38	1.39	1.40	1.42	1.43	21
28	1.28	1.29	1.31	1.32	1.33	1.35	1.36	1.37	1.39	1.40	1.42	1.43	1.44	1.46	1.47	1.48	1.50	22
32	1.34	1.35	1.37	1.38	1.39	1.41	1.42	1.44	1.45	1.47	1.48	1.49	1.51	1.52	1.54	1.55	1.57	23
38	1.39	1.41	1.42	1.44	1.45	1.47	1.48	1.50	1.51	1.53	1.54	1.56	1.57	1.59	1.60	1.62	1.63	24
44	1.45	1.47	1.48	1.50	1.52	1.53	1.55	1.56	1.58	1.59	1.61	1.62	1.64	1.66	1.67	1.69	1.70	25
49	1.51	1.53	1.54	1.56	1.58	1.59	1.61	1.62	1.64	1.66	1.67	1.69	1.71	1.72	1.74	1.75	1.77	26
55	1.57	1.59	1.60	1.62	1.64	1.65	1.67	1.69	1.70	1.72	1.74	1.75	1.77	1.79	1.81	1.82	1.84	27
61	1.63	1.64	1.66	1.68	1.70	1.71	1.73	1.75	1.77	1.78	1.80	1.82	1.84	1.85	1.87	1.89	1.91	28
67	1.69	1.70	1.72	1.74	1.76	1.78	1.79	1.81	1.83	1.85	1.87	1.88	1.90	1.92	1.94	1.96	1.98	29
72	1.74	1.76	1.78	1.80	1.82	1.84	1.86	1.87	1.89	1.91	1.93	1.95	1.97	1.99	2.01	2.02	2.04	30
78	1.80	1.82	1.84	1.86	1.88	1.90	1.92	1.94	1.96	1.98	2.00	2.01	2.03	2.05	2.07	2.09	2.11	31
84	1.86	1.88	1.90	1.92	1.94	1.96	1.98	2.00	2.02	2.04	2.06	2.08	2.10	2.12	2.14	2.16	2.18	32
90	1.92	1.94	1.96	1.98	2.00	2.02	2.04	2.06	2.08	2.10	2.12	2.14	2.17	2.19	2.21	2.23	2.25	33
95	1.98	2.00	2.02	2.04	2.06	2.08	2.10	2.12	2.15	2.17	2.19	2.21	2.23	2.25	2.27	2.29	2.32	34
01	2.03	2.06	2.08	2.10	2.12	2.14	2.17	2.19	2.21	2.23	2.25	2.27	2.30	2.32	2.34	2.36	2.38	35
07	2.09	2.11	2.14	2.16	2.18	2.20	2.23	2.25	2.27	2.29	2.32	2.34	2.36	2.38	2.41	2.43	2.45	36
13	2.15	2.17	2.20	2.22	2.24	2.27	2.29	2.31	2.34	2.36	2.38	2.40	2.43	2.45	2.47	2.50	2.52	37
18	2 21	2.23	2.26	2.28	2.30	2.33	2.35	2.37	2.40	2.42	2.45	2.47	2.49	2.52	2.54	2.56	2.59	38
24	2.27	2.29	2.32	2.34	2.36	2.39	2.41	2.44	2.46	2.49	2.51	2.53	2.56	2.58	2.61	2.63	2.66	39
30	2.32	2.35	2.37	2.40	2.42	2.45	2.47	2.50	2.52	2.55	2.57	2.60	2.62	2.65	2.67	2.70	2.72	40
36	2.38	2.41	2.43	2.46	2.49	2.51	2.54	2.56	2.59	2.61	2.64	2.66	2.69	2.72	2.74	2.77	2.79	41
41	2.44	2.47	2.49	2.52	2.55	2.57	2.60	2.62	2.65	2.68	2.70	2.73	2.76	2.78	2.81	2.83	2.86	42
47	2.50	2.53	2.55	2.58	2.61	2.63	2.66	2.69	2.71	2.74	2.77	2.79	2.82	2.85	2.88	2.90	2.93	43
53	2.56	2.58	2.61	2.64	2.67	2.69	2.72	2.75	2.78	2.80	2.83	2.86	2.89	2.91	2.94	2.97	3.00	44
59	2.62	2.64	2.67	2.70	2.73	2.76	2.78	2.81	2.84	2.87	2.90	2.92	2.95	2.98	3.01	3.04	3.07	45
64	2.67	2.70	2.73	2.76	2.79	2.82	2.85	2.87	2.90	2.93	2.96	2.99	3.02	3.05	3.08	3.10	3.13	46
70	2.73	2.76	2.79	2.82	2.85	2.88	2.91	2.94	2.97	3.00	3.03	3.05	3.08	3.11	3.14	3.17	3.20	47
76	2.79	2.82	2.85	2.88	2.91	2.94	2.97	3.00	3.03	3.06	3.09	3.12	3.15	3.18	3.21	3.24	3.27	48
92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 6

0	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	
7	1.39	1.40	1.41	1.42	1.44	1.45	1.46	1.47	1.49	1.50	1.51	1.52	1.54	1.55	1.56	1.57	1.59	20
4	1.46	1.47	1.48	1.50	1.51	1.52	1.54	1.55	1.56	1.57	1.59	1.60	1.61	1.63	1.64	1.65	1.67	21
1	1.53	1.54	1.55	1.57	1.58	1.59	1.61	1.62	1.64	1.65	1.66	1.68	1.69	1.70	1.72	1.73	1.75	22
8	1.60	1.61	1.62	1.64	1.65	1.67	1.68	1.70	1.71	1.72	1.74	1.75	1.77	1.78	1.80	1.81	1.83	23
5	1.66	1.68	1.69	1.71	1.72	1.74	1.75	1.77	1.78	1.80	1.81	1.83	1.84	1.86	1.87	1.89	1.90	24
2	1.73	1.75	1.77	1.78	1.80	1.81	1.83	1.84	1.86	1.87	1.89	1.91	1.92	1.94	1.95	1.97	1.98	25
9	1.80	1.82	1.84	1.85	1.87	1.88	1.90	1.92	1.93	1.95	1.97	1.98	2.00	2.01	2.03	2.05	2.06	26
6	1.87	1.89	1.91	1.92	1.94	1.96	1.97	1.99	2.01	2.02	2.04	2.06	2.08	2.09	2.11	2.13	2.14	27
2	1.94	1.96	1.98	1.99	2.01	2.03	2.05	2.06	2.08	2.10	2.12	2.13	2.15	2.17	2.19	2.20	2.22	28
9	2.01	2.03	2.05	2.07	2.08	2.10	2.12	2.14	2.16	2.17	2.19	2.21	2.23	2.25	2.27	2.28	2.30	29
6	2.08	2.10	2.12	2.14	2.16	2.17	2.19	2.21	2.23	2.25	2.27	2.29	2.31	2.32	2.34	2.36	2.38	30
3	2.15	2.17	2.19	2.21	2.23	2.25	2.27	2.29	2.31	2.32	2.34	2.36	2.38	2.40	2.42	2.44	2.46	31
0	2.22	2.24	2.26	2.28	2.30	2.32	2.34	2.36	2.38	2.40	2.42	2.44	2.46	2.48	2.50	2.52	2.54	32
7	2.29	2.31	2.33	2.35	2.37	2.39	2.41	2.43	2.45	2.47	2.50	2.52	2.54	2.56	2.58	2.60	2.62	33
4	2.36	2.38	2.40	2.42	2.44	2.46	2.49	2.51	2.53	2.55	2.57	2.59	2.61	2.63	2.66	2.68	2.70	34
1	2.43	2.45	2.47	2.49	2.52	2.54	2.56	2.58	2.60	2.62	2.65	2.67	2.69	2.71	2.73	2.76	2.78	35
7	2.50	2.52	2.54	2.56	2.59	2.61	2.63	2.65	2.68	2.70	2.72	2.74	2.77	2.79	2.81	2.83	2.86	36
4	2.57	2.59	2.61	2.64	2.66	2.68	2.71	2.73	2.75	2.77	2.80	2.82	2.84	2.87	2.89	2.91	2.94	37
1	2.64	2.66	2.68	2.71	2.73	2.75	2.78	2.80	2.83	2.85	2.87	2.90	2.92	2.94	2.97	2.99	3.03	38
8	2.71	2.73	2.75	2.78	2.80	2.83	2.85	2.88	2.90	2.92	2.95	2.97	3.00	3.02	3.05	3.07	3.10	39
5	2.77	2.80	2.82	2.85	2.87	2.90	2.92	2.95	2.97	3.00	3.02	3.05	3.07	3.10	3.12	3.15	3.17	40
2	2.84	2.87	2.90	2.92	2.95	2.97	3.00	3.02	3.05	3.07	3.10	3.13	3.15	3.18	3.20	3.23	3.25	41
9	2.91	2.94	2.97	2.99	3.02	3.04	3.07	3.10	3.12	3.15	3.18	3.20	3.23	3.25	3.28	3.31	3.33	42
6	2.98	3.01	3.04	3.06	3.09	3.12	3.14	3.17	3.20	3.22	3.25	3.28	3.31	3.33	3.36	3.39	3.41	43
2	3.05	3.08	3.11	3.13	3.16	3.19	3.22	3.24	3.27	3.30	3.33	3.35	3.38	3.41	3.44	3.46	3.49	44
9	3.12	3.15	3.18	3.21	3.23	3.26	3.29	3.32	3.35	3.37	3.40	3.43	3.46	3.49	3.52	3.54	3.57	45
5	3.19	3.22	3.25	3.27	3.31	3.33	3.36	3.39	3.42	3.45	3.48	3.51	3.54	3.56	3.59	3.62	3.65	46
3	3.26	3.29	3.32	3.35	3.38	3.41	3.44	3.47	3.50	3.52	3.55	3.58	3.61	3.64	3.67	3.70	3.73	47
0	3.33	3.36	3.39	3.42	3.45	3.48	3.51	3.54	3.57	3.60	3.63	3.66	3.69	3.72	3.75	3.78	3.81	48
0	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 7

129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	
1.61	1.62	1.64	1.65	1.66	1.67	1.69	1.70	1.71	1.72	1.74	1.75	1.76	1.77	1.79	1.80	1.81	20
1.69	1.71	1.72	1.73	1.75	1.76	1.77	1.78	1.80	1.81	1.82	1.84	1.85	1.86	1.88	1.89	1.90	21
1.77	1.79	1.80	1.81	1.83	1.84	1.86	1.87	1.88	1.90	1.91	1.92	1.94	1.95	1.97	1.98	1.99	22
1.85	1.87	1.88	1.90	1.91	1.93	1.94	1.95	1.97	1.98	2.00	2.01	2.03	2.04	2.06	2.07	2.08	23
1.93	1.95	1.96	1.98	1.99	2.01	2.02	2.04	2.05	2.07	2.08	2.10	2.11	2.13	2.14	2.16	2.17	24
2.02	2.03	2.05	2.06	2.08	2.09	2.11	2.12	2.14	2.16	2.17	2.19	2.20	2.22	2.23	2.25	2.27	25
2.10	2.11	2.13	2.14	2.16	2.18	2.19	2.21	2.23	2.24	2.26	2.27	2.29	2.31	2.32	2.34	2.36	26
2.18	2.19	2.21	2.23	2.24	2.26	2.28	2.29	2.31	2.33	2.35	2.36	2.38	2.40	2.41	2.43	2.45	27
2.26	2.27	2.29	2.31	2.33	2.34	2.36	2.38	2.40	2.41	2.43	2.45	2.47	2.48	2.50	2.52	2.54	28
2.34	2.36	2.37	2.39	2.41	2.43	2.45	2.46	2.48	2.50	2.52	2.54	2.56	2.57	2.59	2.61	2.63	29
2.42	2.44	2.46	2.47	2.49	2.51	2.53	2.55	2.57	2.59	2.61	2.62	2.64	2.66	2.68	2.70	2.72	30
2.50	2.52	2.54	2.56	2.58	2.60	2.62	2.63	2.65	2.67	2.69	2.71	2.73	2.75	2.77	2.79	2.81	31
2.58	2.60	2.62	2.64	2.66	2.68	2.70	2.72	2.74	2.76	2.78	2.80	2.82	2.84	2.86	2.88	2.90	32
2.66	2.68	2.70	2.72	2.74	2.76	2.78	2.80	2.83	2.85	2.87	2.89	2.91	2.93	2.95	2.97	2.99	33
2.74	2.76	2.78	2.80	2.83	2.85	2.87	2.89	2.91	2.93	2.95	2.97	3.00	3.02	3.04	3.06	3.08	34
2.82	2.84	2.87	2.89	2.91	2.93	2.95	2.97	3.00	3.02	3.04	3.06	3.08	3.11	3.13	3.15	3.17	35
2.90	2.92	2.95	2.97	2.99	3.01	3.04	3.06	3.08	3.10	3.13	3.15	3.17	3.19	3.22	3.24	3.26	36
2.98	3.01	3.03	3.05	3.08	3.10	3.12	3.14	3.17	3.19	3.21	3.24	3.26	3.28	3.31	3.33	3.35	37
3.06	3.09	3.11	3.13	3.16	3.18	3.21	3.23	3.25	3.28	3.30	3.32	3.35	3.37	3.40	3.42	3.44	38
3.14	3.17	3.19	3.22	3.24	3.27	3.29	3.31	3.34	3.36	3.39	3.41	3.44	3.46	3.49	3.51	3.53	39
3.22	3.25	3.27	3.30	3.32	3.35	3.37	3.40	3.42	3.45	3.47	3.50	3.52	3.55	3.57	3.60	3.62	40
3.31	3.33	3.36	3.38	3.41	3.43	3.46	3.48	3.51	3.54	3.56	3.59	3.61	3.64	3.66	3.69	3.72	41
3.39	3.41	3.44	3.46	3.49	3.52	3.54	3.57	3.60	3.62	3.65	3.67	3.70	3.73	3.75	3.78	3.81	42
3.47	3.49	3.52	3.55	3.57	3.60	3.63	3.65	3.68	3.71	3.74	3.76	3.79	3.82	3.84	3.87	3.90	43
3.55	3.57	3.60	3.63	3.66	3.68	3.71	3.74	3.77	3.79	3.82	3.85	3.88	3.90	3.93	3.96	3.99	44
3.63	3.66	3.68	3.71	3.74	3.77	3.80	3.82	3.85	3.88	3.91	3.94	3.97	3.99	4.02	4.05	4.08	45
3.71	3.74	3.77	3.79	3.82	3.85	3.88	3.91	3.94	3.97	4.00	4.02	4.05	4.08	4.11	4.14	4.17	46
3.79	3.82	3.85	3.88	3.91	3.94	3.97	3.99	4.02	4.05	4.08	4.11	4.14	4.17	4.20	4.23	4.26	47
3.87	3.90	3.93	3.96	3.99	4.02	4.05	4.08	4.11	4.14	4.17	4.20	4.23	4.26	4.29	4.32	4.35	48
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	

COMPILATION TABLES FOR 8 FOOT ROUGH PULPWOOD STACKED SCALE - 8

147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	
1.84	1.85	1.86	1.87	1.89	1.90	1.91	1.92	1.94	1.95	1.96	1.97	1.99	2.00	2.01	2.02	2.04	2.05	20
1.93	1.94	1.96	1.97	1.98	1.99	2.01	2.02	2.03	2.05	2.06	2.07	2.09	2.10	2.11	2.13	2.14	2.15	21
2.02	2.03	2.05	2.06	2.08	2.09	2.10	2.12	2.13	2.14	2.16	2.17	2.19	2.20	2.21	2.23	2.24	2.25	22
2.11	2.13	2.14	2.16	2.17	2.18	2.20	2.21	2.23	2.24	2.26	2.27	2.29	2.30	2.31	2.33	2.34	2.36	23
2.20	2.22	2.23	2.25	2.26	2.28	2.29	2.31	2.32	2.34	2.35	2.37	2.38	2.40	2.41	2.43	2.44	2.46	24
2.30	2.31	2.33	2.34	2.36	2.37	2.39	2.41	2.42	2.44	2.45	2.47	2.48	2.50	2.52	2.53	2.55	2.56	25
2.39	2.40	2.42	2.44	2.45	2.47	2.49	2.50	2.52	2.53	2.55	2.57	2.58	2.60	2.62	2.63	2.65	2.66	26
2.48	2.50	2.51	2.53	2.55	2.56	2.58	2.60	2.62	2.63	2.65	2.67	2.68	2.70	2.72	2.73	2.75	2.77	27
2.57	2.59	2.61	2.62	2.64	2.66	2.68	2.69	2.71	2.73	2.75	2.76	2.78	2.80	2.82	2.83	2.85	2.87	28
2.66	2.68	2.70	2.72	2.74	2.75	2.77	2.79	2.81	2.83	2.85	2.86	2.88	2.90	2.92	2.94	2.95	2.97	29
2.76	2.77	2.79	2.81	2.83	2.85	2.87	2.89	2.91	2.92	2.94	2.96	2.98	3.00	3.02	3.04	3.06	3.07	30
2.85	2.87	2.89	2.91	2.93	2.94	2.96	2.98	3.00	3.02	3.04	3.05	3.08	3.10	3.12	3.14	3.16	3.18	31
2.94	2.96	2.98	3.00	3.02	3.04	3.06	3.08	3.10	3.12	3.14	3.16	3.18	3.20	3.22	3.24	3.26	3.28	32
3.03	3.05	3.07	3.09	3.11	3.13	3.16	3.18	3.20	3.22	3.24	3.26	3.28	3.30	3.32	3.34	3.36	3.38	33
3.12	3.14	3.17	3.19	3.21	3.23	3.25	3.27	3.29	3.31	3.34	3.36	3.38	3.40	3.42	3.44	3.46	3.48	34
3.22	3.24	3.26	3.28	3.30	3.32	3.35	3.37	3.39	3.41	3.43	3.46	3.48	3.50	3.52	3.54	3.57	3.59	35
3.31	3.33	3.35	3.37	3.40	3.43	3.44	3.46	3.49	3.51	3.53	3.55	3.58	3.60	3.62	3.64	3.67	3.69	36
3.40	3.42	3.45	3.47	3.49	3.51	3.54	3.56	3.58	3.61	3.63	3.65	3.68	3.70	3.72	2.75	3.77	3.80	37
3.49	3.51	3.54	3.56	3.59	3.61	3.63	3.66	3.68	3.70	3.73	3.75	3.78	3.80	3.82	3.85	3.87	3.89	38
3.58	3.61	3.63	3.66	3.68	3.70	3.73	3.75	3.78	3.80	3.83	3.85	3.88	3.90	3.92	3.95	3.97	4.00	39
3.67	3.70	3.72	3.75	3.77	3.80	3.82	3.85	3.87	3.90	3.92	3.95	3.97	4.00	4.02	4.05	4.07	4.10	40
3.77	3.79	3.82	3.84	3.87	3.89	3.92	3.95	3.97	4.00	4.02	4.05	4.07	4.10	4.13	4.15	4.18	4.20	41
3.86	3.88	3.91	3.94	3.96	3.99	4.02	4.04	4.07	4.09	4.12	4.15	4.17	4.20	4.23	4.25	4.28	4.30	42
3.95	3.98	4.00	4.03	4.06	4.08	4.11	4.14	4.17	4.19	4.22	4.25	4.27	4.30	4.33	4.35	4.38	4.41	43
4.04	4.07	4.10	4.12	4.15	4.18	4.21	4.23	4.26	4.29	4.32	4.34	4.37	4.40	4.43	4.45	4.48	4.51	44
4.13	4.16	4.19	4.22	4.25	4.27	4.30	4.33	4.36	4.39	4.42	4.44	4.47	4.50	4.53	4.56	4.58	4.61	45
4.23	4.25	4.28	4.31	4.34	4.37	4.40	4.43	4.46	4.48	4.51	4.54	4.57	4.60	4.63	4.66	4.69	4.71	46
4.32	4.35	4.38	4.41	4.44	4.46	4.49	4.52	4.55	4.58	4.61	4.64	4.67	4.70	4.73	4.76	4.79	4.82	47
4.41	4.44	4.47	4.50	4.53	4.56	4.59	4.62	4.65	4.68	4.71	4.74	4.77	4.80	4.83	4.86	4.89	4.92	48
147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	

TABLE SHOWING APPROXIMATE NUMBER OF PIECES BY DIAMETER REQUIRED FOR ONE CORD OF ROUGH PULPWOOD

Diameter Measured Inside Bark	Approximate Number of Pieces Per Cord
4	121
5	78
6	54
7	40
8	30
9	24
10	19
11	16
12	14
13	12
14	10
15	9
16	8

Table showing approximate number of pieces by diameter required for one cord of rough pulpwood.

2.10.5 FACTORS TO BE USED IN ADJUSTMENT IN CORD VOLUMES OF ROUGH OR PEELED PULPWOOD DUE TO VARIATION IN BOLT LENGTH FROM FOUR FEET

Footage	Percentage of Volume to be Raised
1"	2.08
2"	4.16
3"	6.24
4"	8.32
5"	10.40
6"	12.50
7"	14.58
8"	16.66
9"	18.74
10"	20.81
11"	22.90
12"	25.00

Table - Factors to be used in adjustment in cord Volumes of Rough or Peeled Wood due to variation in bolt length from 4 feet. Bolts cut under the prescribed length of 48" will be considered as full length bolts and no deductions will be allowed.

22.10.6 FACTORS TO BE USED IN ADJUSTMENT IN CORD VOLUME OF ROUGH OR PEELED PULPWOOD DUE TO VARIATION IN BOLT LENGTH FROM EIGHT FEET

Footage	Percentage of Volume to be Raised
1"	1.04
2"	2.08
3"	3.12
4"	4.16
5"	5.20
6"	6.25
7"	7.29
8"	8.33
9"	9.37
10"	10.41
11"	11.45
12"	12.50

Table - Factors to be used in adjustment in Cord Volumes of Rough or Peeled Wood due to variation in bolt length from 8 feet. Bolts cut under the prescribed length of 96" will be considered as full length bolts and no deductions will be allowed.

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

FOREST MANAGEMENT
CRUISE AND REPORT PROCEDURE

CHAPTER 23

Revised - May 1961

FOREST MANAGEMENT
CHAPTER 23

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FOREST MANAGEMENT

CHAPTER 23

CRUISE AND REPORT PROCEDURE

23.1 Introduction

A prerequisite to the entire forest management cruise and report procedure is a good understanding of and continual reference to The Forests Act, regulations, rulings, directives and other administrative aspects.

Cruising is an important tool of forest management. The cruiser makes measurements and observations related to volume present, growth rate, health, site, timber quality, topography and other conditions of the forest and the land. Based upon these measurements and observations, he makes recommendations dealing with time and method of harvest and with silvicultural treatments which appear favourable to continuation of forest growth.

The cruiser who does his job conscientiously and well is the key man in the conservation and management of this most important natural resource. A person who is willing to apply himself and to exercise his powers of observation can become an efficient cruiser.

With these factors in mind the mechanics of cruising are listed which will include office preparation, field examination, compilation and of the Forest Management cruise report.

Each of these stages will be dealt with and, needless to say, they do not cover every point which will arise in the field, but the organization and layout of the work as it is described here must be followed. All work that is carried out on proposed Licence Timber Berths and Special and Fringe Timber Permit Areas must, for the sake of uniformity, conform to this outline.

23.2 Crew and Responsibility

23.2.1 Party Chief or Assistant Party Chief - Responsible for two or more crews, plans and delegates work.

23.2.2 Cruiser - In a two or three man crew the cruiser is responsible for the planning and quality of the office and field work.

23.2.3 Compassman - Takes instruction from and is responsible to the cruiser.

23.3 Office Preparation

As much of the work as possible should be completed in the office before going out to the field. This allows more time when out on

the job, and ensures accuracy in detailed work, such as drafting and map measurements which are difficult to carry out in the field.

The procedure is outlined below:

23.3.1 Type Map

Designate types to be investigated by appropriate coloring of all possible merchantable types. Delineate other interests and boundaries and divide sections into legal subdivisions and number. Select tentative boundary to obtain a timber unit surrounded by natural boundaries whenever practicable. Refer to other information available such as contour maps, photographs, cruise reports of adjacent areas, etc. The type map shall be regarded only as a guide until proven satisfactory or corrected in the field. It is the duty of the cruiser to confirm or modify it according to his observations on the ground both by area and by type. Determination of merchantable type areas is a major aspect of all cruises.

Number all type areas to be inspected for easy reference and compilation.

23.3.2 Cruise Intensity

In the following table, cruise intensity in per cent is given. The number of 1/4-acre plots required may be calculated to come within 10% accuracy. For example, in a B4SwP type of 1,000 acres a 0.96% cruise is required or 9.6 acres or approximately 38 plots are to be evenly distributed throughout the area. In a 40 acre cruise of B4SwP type 19.52% cruise is required for 10% accuracy, or 7.8 acres, or 31 plots should be sampled.

It is obvious that the time and expense involved in cruising to the above intensity in stands below 500 acres is unreasonable in a cruise where dues may be based on sales. In areas less than 500 acres, plots may be laid out at 5 chain intervals with 10 chain spacing between strips.

However, where a cruise is being made to sell timber on tree scale, the intensity of cruise given in the table should be followed as a minimum cruise per cent. In small areas continuous strip cruising may be used to advantage with strips 1/2 or 1 chain wide depending on density of timber.

For areas greater than 1,000 acres a cruise intensity of at least 1% should be used.

23.3.3 Cruise Intensity Table

On the assumption that the cruiser will be satisfied with odds of 22 to 1 in sampling error, (t=2). Size of sample plot will be a quarter-acre. Then required percentage of cruise will be:

$$P = \frac{100\ c^2}{Aa^2 + c^2}$$

where A is the area of the tract to be cruised in acres,
a is the limit of error of mean divided by 100.

Predominantly Sw				Predominantly Pl		
	Density			Density		
	A	B	C	A	B	C
c^2	0.186	0.097	0.108	-	0.163	0.066
Acreage	Required percentage of Cruise					
1000	1.83	0.96	1.07	1.60	.66	
900	2.02	1.07	1.18	1.78	.73	
800	2.27	1.20	1.33	2.00	.82	
700	2.59	1.37	1.52	2.28	.93	
600	3.01	1.59	1.77	2.64	1.09	
500	3.59	1.90	2.11	3.16	1.30	
400	4.44	2.37	2.63	3.92	1.62	
300	5.84	3.13	3.47	5.15	2.15	
200	8.51	4.62	5.12	7.54	3.19	
100	15.68	8.84	9.75	14.02	6.19	
80	18.86	10.81	11.89	16.93	7.62	
60	23.66	13.92	15.25	21.36	9.91	
50	27.11	16.25	17.76	24.58	11.66	
40	31.74	19.52	21.26	28.95	14.16	
30	38.27	24.43	26.47	35.20	18.03	
20	48.19	32.66	35.06	44.90	24.81	
10	65.03	49.24	51.92	62.98	39.76	

23.3.4 Plot Layout

The locations of the plots, as they are intended to be placed in the field should be marked on the detailed type map. These may or may not be the final locations, depending on conditions of the ground. However, they should be accurately marked in the office and numbered consecutively in the field when decision made that a tally is in order. Plots should be located at least two chains within a type boundary.

The distribution of the plots will be controlled by the following factors:

(1) The plots should be laid out in such a manner as to spend the least time travelling from one to another.

(2) All types areas of height classes three and four (60 feet and up), except pure hardwood types must be checked and reported on. In the sub-alpine region and possibly in adjacent lands, some two height class types (2y-46' -60') require ground inspection to ascertain whether they are of merchantable size and require sampling.

(3) Plots will be distributed mechanically, i.e., they will be laid out along parallel cruise lines at regular intervals, employing full tape lengths whenever possible, and the cruise lines themselves will be separated by a constant distance whenever practicable. It is advisable to stagger the plots on alternate lines.

(4) To achieve more accurate sampling, locate traverses so as to cross ridges and water courses at right angles.

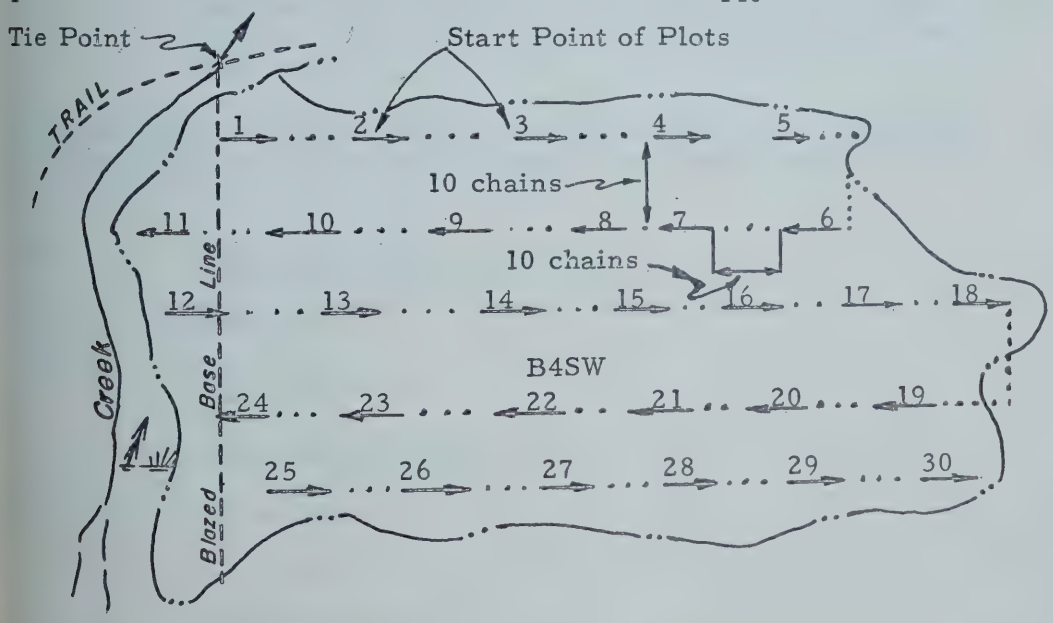
Bearing and distances between the plots should be measured in the order that the work is to be done. These may be written on the tally cards for easy reference in the field. Draw the traverse on the detailed type map (4" to 1 mile).

Plots well distributed over the whole of a merchantable block represent the characteristic variation of the volume within the sale unit. In applying the line sample-plot system to larger stands, a base or control line is first established from which cruise lines are run equal distances apart and sample plots are taken at regular intervals along the cruise lines, shifting plots in relation to the plots on adjacent lines. The cruise lines whenever practicable should be run approximately at right angles to the general contour and usually in cardinal directions. This mechanical procedure usually produces a closer estimate than random sampling.

The table below indicates cruise line and plot spacing using 1/4-acre sample plots to achieve approximate cruise intensities.

Cruise line Spacing	Plot Spacing	Plot Size	Per cent of Area Sampled
20 ch.	10 ch.	1/4 ac.	0.83%
10 ch.	10 ch.	1/4 ac.	1.67%
10 ch.	5 ch.	1/4 ac.	2.5 %
15 ch.	10 ch.	1/4 ac.	1.11%

The following diagram gives plot spacing of 10 chains and line spacing of 10 chains on an area of 440 acres. Since 30 one-quarter acre plots are located on the area, the sampled area will be $\frac{30}{4}$ or 7.5 acres. The percentage cruise will be $\frac{75}{440} \times 100 = 1.7\%$.



23.3.5 Start and Tie Points

The possible start and tie points should be chosen in the office and marked on the map before going to the field. The points should be chose for two characteristics; Ease of recognition and nearness to work. Where these requirements cannot be met it is better to choose one that may be accurately identified rather than one which is closer to the work but doubtful. However, the closer the start point to the first plot, the less time will be spent chaining and the less chance for error in the work.

Tie points are those features recognizable on the map which will be traversed in the course of the day's work. The party's position in relation to them in the field will provide a valuable check on the accuracy of campassing and chainage. The accuracy of the traverse will greatly increase with the greater number of tie and start points employed and also in frequent checking in crossing topographical features and definite type boundaries. All cruise lines should be tied in to definite points at start and finish.

Points suitable for start and tie points are listed below.

1. Survey line intersections.
2. Definite points on lake shores, e.g., points, creek mouths, etc.
3. Man-made structures such as cabins which are shown on the detailed type map (4" to 1 mile).
4. Creek junctions (but not irregularities in the water-course).
5. Definite points on bush roads which are shown on the map, e.g., junctions, gravel pits, etc.
6. Intersections of definite type boundaries identifiable on the ground, e.g., as between burn and timber, open muskeg and timber.

Note that mill and campsites are unsuitable with use of a type map alone but may be in order when using recent photographs with the type map.

23.3.6 Equipment Check by Cruiser

1. Calipers.
2. Diameter tape.
3. Abney level (topographic).
4. Type map.
5. Protractor.
6. Engineer's Scale 6".
7. Pencils.

The cruiser, or if there are more than one, one of the cruisers, acts as rear chainman, and it is his duty to see that correct chainage is maintained.

Normally the senior man will carry out the cruising and he will also write up the description of each plot as required by the tally sheet.

The senior man will be responsible for the cruise, however, rotation of duties is strongly recommended as a means of training personnel, to relieve monotony and achieve increased accuracy and interest.

23.4.2 Tie Points

Find the tie point on the ground with the aid of photos and type map as under 23.3 aforementioned. If the point selected cannot be found or cannot be positively identified move to an alternate tie point. Recalculate bearing and distance to first plot, blaze a tree and mark cruiser's initials, date and calculated distance and bearing to first plot. This point is now an identifiable blaze and should be marked on the type map "X" Starting Point.

23.4.3 Proceeding to the First Plot

Reference is made to the bearings and distances which have been computed in this office. The tallyman will set his compass accordingly and proceed on this bearing. The cruiser will see to it that the correct number of chains is travelled to bring the party to the beginning of the first plot.

The two chain type plus trailer may be used where slopes do not exceed 10%. The 2 1/2 chain length comes between the graduates 49 and 50 on the trailer.

Where slopes exceed 10% the two chain tape should be used and the trailer used in conjunction with the topographic abney.

23.4.4 Field Mapping

The compassman should be made responsible for mapping. He should map stream crossings, swamps, type changes, chainage distance and plot locations at a scale of 20 chains to the inch. The cruiser must be consulted in mapping type changes.

23.4.5 Plots - Blazing

Upon arrival at the first plot a tree should be blazed on 4 sides and the following information written, date, plot number, direction travelled, cruiser's initials.

Example:

January 31, 1961
Plot # 1
going west

When plots are blazed at start and finish it is proof that the plot was taken, but more important, it may then be checked by the party chief, forester or check cruiser.

8. Lumber crayon.

9. Aerial photos.

10. Photo holder.

11. Stereoscope.

12. Standard Volume Table.

13. Cruise vest or rucksack.

14. Compass.

23.3.7 Equipment Check by Compassman

1. Compass.

2. Chain.

3. Increment borer.

4. Boys axe.

5. Tally book,

6. Tally sheets.

7. Map sheets.

8. Chain menders.

9. Cruise vest or rucksack.

23.4 Field Examination

It is essential to have the field examination well planned before going out to the field. Unless the cruiser keeps in mind just what he is going to do, what measurements he is going to take, and what bearings he will travel on from point to point a good deal of time will be wasted deciding these things in the field. This is the reason for completing as much of the work as possible in the office; office work should not be carried out in the field any more than the field work should be done in the office.

23.4.1 Crew

The minimum size for a cruising crew is two men, one cruiser and one tallyman.

When the crew is composed of three men, one acts as tallyman and two men cruise.

With four men the most effective distribution is: One tallyman, two cruisers and one man who measures heights and takes increment borings.

In all cases the tallyman also carries out the compassman's duties and functions as head chainman.

23.4.6 Check Cruising

The Divisional forester will be responsible to see that a check cruise of one or more plots is carried out on all cruised areas.

The check cruise will be made by the forester or by the party chief. Plots should be selected at random and the cruiser advised of the results.

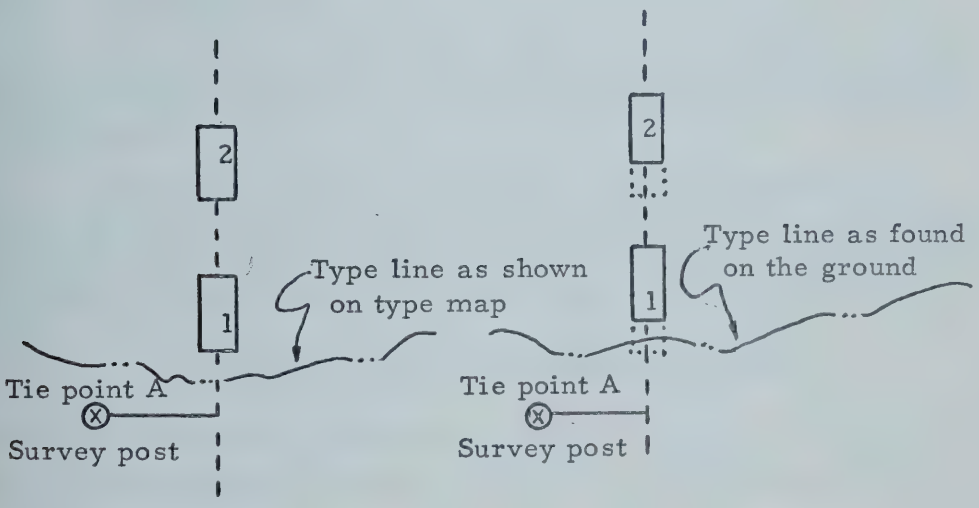
23.4.7 Unbiased Sample

If you arrive at your proposed location for the plot and you find that the area is barren because of swamp you should not move the location of the plot but merely put down, "swamp no tally".

If you find the stand to be sparse because of blow down or poor stocking you should complete the plot as planned. You must assume that within a type the plots will fall in a variety of conditions and that an average of these plots will give you the average volume for the stand.

Plots may be moved where they land on seismic lines or roads that do not show on the type map. They should also be moved where they are found to land on a type line because of an error in the type map.

For example:



All plots should be moved ahead 5 chains as shown by dotted plot outline.

Most cruisers will estimate diameter by eye fairly accurately but here again the same rules apply as they did to strip width and constant checks should be made on estimate. In fact, on each plot at least 60% of the merchantable trees should be calipered.

Count number of saplings and seedlings by species at exact end of each plot in an area 6.6 feet square and record this count on the back of the tally sheet in the space allotted (stocked quadrat).

A sapling is a young tree less than 4 inches in diameter at breast height. The minimum size of saplings is usually placed at 2 inches breast height.

A seedling is a young tree below sapling size.

23.4.10 Cull Tally

Cull trees will be included in the tally. In addition, the percentage cull estimated for each cull tree will be entered in the cull square below the tally square. Only the first figure of the percentage will be recorded here, i.e., 1 for 10%, 3 for 30%, etc., and 0 constituting 100% cull. Trees should be observed from various positions to estimate cull. Recent windthrown trees should be culled in the same manner, i.e., as though they were standing. "Recent" pertains to the past year in regards to windfall.

23.4.11 Cull Estimate

Estimate the percentage cull of the trees tallied by conks, increment borings that show rot, fire scar, broken tops, swollen knots, school marms, etc.

The table below may be used as a guide in estimating the percentage of a tree affected by cull. The table gives an approximation of the volume found in various sections of trees of different lengths. A tree with less than 50% merchantable volume should be considered as a cull.

NUMBER OF 16 FOOT LOGS PER TREE

	1	2	3	4	5
% by logs.	100%	1. 68 2. 32	1. 54 2. 33 3. 13	1. 43 2. 32 3. 18 4. 17	1. 37 2. 30 3. 21 4. 9 5. 3

23.4.8 Individual Plot Layout - 5 chains by 1/2 chain (1/4 acre)

Starting from the blazed tree the compassman will proceed on course for 2 or 2 1/2 chains depending on density of timber and slope. In steep ground where slope must be allowed 2 chain distance should be used. Where slopes are in excess of 50° on the topographic abney, one chain distance should be used. Where timber is dense the chainage distance may have to be stopped at 2 chains because of the difficulty of hearing the cruiser.

At the start of the plot the cruiser should check plot width, first by estimating the distance of 1/4 chain and then by measuring the estimated and actual distance to the edge of plot. By this system of estimating distance and checking he will soon be able to tell within a few inches if trees are in or out. Frequent checks on plot width should be made in type changes. As the stands become more open grown there is a tendency to over-estimate plot width and conversely as a stand becomes more dense there is a tendency to under-estimate plot width.

Other factors that have a bearing on the ability to estimate strip width are fatigue, weather and hunger. When the cruiser becomes tired or hungry his paces will become shorter. On dull cloudy days strip width will appear different than on clear sunny days.

23.4.9 Tree Tally

Once the plot width has been definded the cruiser will start measuring the trees with calipers. An inexperienced cruiser should tally one side of the chain up to an easily defined point and then measure trees on the opposite side of the chain. This method of tally should also be used by the experienced cruiser when the tally is very heavy and there is a possibility of missing trees or measuring trees twice.

Borderline trees should be tallied in the plot if more than half the width of the stem is inside the plot; otherwise they should be excluded. Keep glancing at the crowns of the trees to make sure that no dead or broken stems are tallied. All trees on the plot, windthrown within the last year, should be tallied separately by species and diameter classes. This will be done in order to determine salvage value and weight of deterioration of the stand and will apply only to down trees with needles or leaves attached.

The record is kept by the tallyman, who enters each tree in its appropriate square of the tally sheet by the dot system.

Trees should be measured at D.B.H. (Diameter Breast High) to the nearest inch down to 10 inches, i.e. 9.6 inches on sawlog sales. D.B.H. is the diameter at a point 4 1/2 feet from average ground level. Where oval trees are encountered two measurements should be made at right angles to each other and the two diameters averaged. When pronounced butt swell trees are found to extend above D.B.H., diameter should be taken just above the swell. Trees below 9.6 inches and above 3.6 inches in diameter must be tallied but the diameter may be called to the tallyman with occasional caliper measurements to keep "ones eye in".

Example: If the first 16 feet of a 5 log tree was lost through cull, 37% of the volume of that tree would be lost, or if 1/3 of the butt log were affected the cull % loss would be 12% approx. for that tree.

If you are unfamiliar with the area you are cruising, visit adjacent logged areas and note butt rot in stump and cull logs left in the woods. Note trees broken by wind - were they rotten in the bole at the break but sound in the butt?

23.4.12 Cull Tally for White Spruce

Cull tally by cull indicator method for white spruce.

The cull indicator method is based on the fact that the trees with visible defects such as scars or broken tops will have a greater chance of becoming infected than those with no visible defects. A certain amount of decay is also present in trees with no visible defect, but the amount of decay in these trees is related fairly closely to the age of the stand. Stand age and the percentage of trees with each type of defect can be determined during the cruise, and the cull estimate made from these data.

The table below shows average cull percent for each class of suspect tree and for each 10 year age class for non suspect trees.

Percentage of Cull by Tree Class for White Spruce

CLASS	CULL PERCENT
Non-Suspect	
100 years	3.1
110	3.4
120	3.2
130	2.8
140	3.6
150	4.4
160	6.0
170	7.7
180	9.6
190	11.3
200	12.1
210	11.9

CLASS	CULL PERCENT
Suspect	
Conk or punk knots	65.8
Old broken tops	35.7
Scars or other defects	11.5

During the cruise the number of trees falling in each suspect class would be tallied separately. The percentage of trees in each class is then calculated.

EXAMPLE:-

Diam.	Non Suspect	Conks & Punk Knots	Old Broken Tops	Scars & Other Defects
8	2			1
9	3			
10	4			2
11	5	2		
12	6	1		1
13	7	1		2
14	2	2	1	1
15	2	2	2	2

Total Trees Tallied.	Non suspect	68	or	70.8%
	Conks and punk knots	12		12.5%
	Old broken tops	5		5.2%
	Scars and other defects	11		11.5%
		96		100%

Assume the average age of the stand was found to be 140 years. The cull percent on the non suspect would be 3.6% from the table. The cull percent for the stand would be equal to the percent of the trees in the non suspect, expressed as a decimal, times the cull percent for 140 year old spruce stand; plus the percent of trees with conks, as a decimal, times 65.8; plus the percent of trees with broken tops, as a decimal, times 35.7; plus the percent of trees with other defects times 11.5:

.708 x 3.6 2.55%
.125 x 65.8 = 8.22
.152 x 35.7 = 1.85
.115 x 11.5 = 1.32
13.94%

cull factor for this 140 year spruce stand would be 14%.

The aforementioned method requires some additional work in compilation but the increased accuracy in determining cull is well worth the effort.

23.5 Information Required on Tally Sheets

Before proceeding to the next plot make sure that all the information that is required is filled out on the tally sheet form 189. Do not leave anything to memory.

Date

R.D. - Ranger District

T.A. - Timber Application number

M. unit - Management Unit number

B. Map - Base Map number

L.S. - Legal Subdivision

Sec. - Section

Tp. - Township

Rg. - Range

W. mer. - West of_____meridian.

The above information with the exception of the date may be obtained from the type map provided.

Area number

Plot number

Size of plot

Photo numbers

Area number refers to the number you have designated to the type.

23.5.1 Age Class

Total age varies according to the two principal forest regions of Alberta which are named the Boreal and Subalpine Forest Regions. The 4,000 foot elevation is generally employed as the approximate line of demarcation.

The average total age of representative dominant trees of each species of importance is compared with the applicable table on the next page and finally recorded in the cruise report.

23.5.2 Basal Area

Refers to basal area in square feet per acre. This is used in scientific studies and may be left blank in our cruising.

23.5.3 Interpreted Type is the type as interpreted from the aerial photos and is the same as sub type below.

23.5.4 Sub Type example - C3SwPA - C is the density, 3 is the height class. The type contains more spruce than pine and each conifer contains more than 10% of the total volume of the type.

23.5.5 Field Type is a field check on the interpreted type.

23.5.6 Stand Density

A. Up to 30% max. crown closure (sparsely stocked).
B. 31-70% max. crown closure (medium stocked).
C. 71-100% max. crown closure (fully stocked).
D. Excessive number of trees (over-stocked).

23.5.7 Height Classes

1 Up to 30 feet.
2x 31-45 feet.
2y 46-60 feet.
3 61-80 feet.
4 81 feet and over.

23.5.8 Bearing is the bearing or direction of the plot and is usually a cardinal direction, i.e., N: S: E: or W.

23.5.9 Starting Point is the starting point of the plot and should be referred back to either the tie point or the previous plot; example - 20 chains east and 5 chains south of the named tie point.

23.5.10 Sample Trees

Pure Stands - Take one sample tree per plot which is representative of the plot.

Mixed Stands of two species of equal volume - Take a sample of one tree of each species.

Mixed Stands of two or more species where one species contributes a minor volume - The minor species should be sampled to gain information required but need not be sampled on every plot.

23.5.11 Species

Use symbols, i.e., white spruce - Sw, lodgepole pine = Pl

23.5.12 D.B.H. Outside the Bark (D.B.H.O.B.)

D.B.H. includes bark thickness to nearest 1/10 inch measured with diameter tape or calipers.

23.5.13 Stump Diameter (S.D.) - Measured to nearest 1/10" at 12" from the ground with diameter tape or calipers.

23.5.14 Age at Stump

Increment borings should be taken at stump height to determine age. Total age may be estimated by adding the number of years the tree took to reach stump height.

23.5.15 Radial Growth Last 10 Years

Trees must be bored at D.B.H. to determine the growth rate during the last 10 years. Measurements should be estimated to the nearest 1/100 of an inch with an engineer's scale rule. Stump increment readings will not give a true picture of growth because of butt swell.

Age and growth readings may both be taken at D.B.H. for a timber type if the difference in age between stump and D.B.H. is determined by boring one or two trees. In the boreal forest regions there may be a difference of from 5 to 25 years for a tree to attain breast height.

23.5.16 Compare Current with Past Growth

Calculate per cent increase in volume by the formula

$$P = \frac{40\ R}{D}$$

Where P = current annual growth per cent

R = radial growth inside the bark in the last 10 years

D = diameter in inches D.B.H. outside bark

An example has been worked out for a stand averaging 12, 672 f.b.m. per acre. Merchantable diameters varied from 9 to 20 inches with the heaviest tally in the 14 to 15 inch classes. A sample tree of 14.6 inch D.B.H. had been bored and the radial growth in the last 10 years was found to be 0.5 inches. Substituting in the formula

$$P = \frac{40\ R}{D}$$

$$P = \frac{40 \times 0.5}{14.6}$$

P = 1.37% per year growth increase or 1.37 f.b.m. per 100 f.b.m. of standing timber. Since there is 12,672 f.b.m. per acre, a rough approximation would be 126.72 x 1.37 or 173 f.b.m. per acre per year growth increase. If the stand is losing one or more trees per acre of a diameter 14 inches or greater one could suspect that the stand is losing volume and could recommend harvest.

Percent growth must be related to average trees in the stand and to volume and most growth calculations will be done at the time of compilation.

23.5.17 Bark Thickness should be recorded to the nearest 1/10 inch and is taken at D.B.H.

23.5.18 Total Height

Total height measurements should be made with an abney. Use the chain to get horizontal distance from the tree. Measurements should be made from ground to the tip of the tree. Two or more representative trees in each diameter class, over the whole range of diameter classes represented in the stand must be measured for height and diameter. These will be used to construct a height-diameter curve.

23.5.19 Crown Class

D - Dominant - Above the general level of the crown canopy and receives light from 4 sides - generally large well developed crown.

CD - Co-dominant - Forming the general level of the crown cover and receives full light from above but comparatively little direct light from the sides.

I - Intermediate - Trees shorter than the two above but with crowns extending into the crown cover formed by dominant and co-dominant receiving a little direct light from above but none from the sides - usually small crown crowded on the sides.

S - Suppressed - Trees entirely below the general level of the crown cover and receiving no direct light from above or from the sides.

23.5.20 Tree Quality

Clean or limby - A clean tree is considered to have one or more 16 foot logs clear of limbs in the boreal region and 2 or more 16' logs clear of limbs in the subalpine region.

Culi - See 23.4.11 aforementioned.

23.5.21 Drainage

Excessive - Sand or gravel soil. Slopes over 50%

Normal - Considerable clay soil. Slopes 20 - 50%.

Retarded - water logged soil, swamps and bogs. Slopes 0 - 20%.

23.5.22 Underbrush and Ground Cover

Heavy underbrush and ground cover will impede the establishment of regeneration and will affect the recommendations of logging and silvicultural treatment.

Example 1: Mature spruce stand with a heavy layer of moss 3-4" deep.

Recommend area to be clear cut in strips or patches and the cut strips to be scarified. No restriction on method of logging would be made on the clear cut area.

Example 2: Spruce-pine stand with little underbrush and light ground cover. Area to be marked for cutting.

Scarification not required. Recommend tractors, of not over gauge of 60 inches, or horses to be used for skidding. Dozer blade to be removed while skidding. Gauge is the distance between the tracks measured centre to centre.

Example 3: Spruce stand with heavy grass sod. Area to be selectively logged.

Recommend planting rather than scarification as a heavy sodded area will again grass over before seedlings can become established.

23.5.23 Soil Type

The sand or clay content of the soil is to be estimated and the texture described (coarse, medium, fine) as well as its moisture (wet, moist, dry) and depth of duff.

23.5.24 Physical Defects

Frost checks, fire scar, school marms, crook, sweep, butt rot, trunk rot and broken tops.

23.5.25 Disease Attacks

Root rot, butt rot and top rot, state name when recognized. Learn to recognize the most common conks and the rots they cause.

23.5.26 Insect Attack

Rate attack as - no attack.
- minor attack.
- major insect attack.

State damage being done, defoliators, bark beetles, wood borers, root weevils, etc.

23.5.27 Disturbances

Fires, windthrow, previous logging, flood damage, hail or snow damage.

23.5.28 Crown Ratings

Rule of thumb	
Below normal 1/3 or less crown	- 33 1/3%
Normal 1/3 - 1/2	- 33 1/3-50%
Above normal 1/2-full crown	- 50-100%

A tree with 1/3 or less crown will not release if other trees are cut around it. It is more apt to die from sun scald than a tree of normal or above normal crown. It is more subject to windfall than a tree of larger crown.

Thinnings should begin when the crown ratio reaches 40%, that is, cut the normal and below normal trees. Trees with 50 - 100% crown should be capable of further growth increment.

23.5.29 Slope %

Take average slopes of the area with the abney on topographic arc and convert to percent reading by multiplying by 1 1/2. A reading of 10^{o} on the topographic is approximately 15% slope.

23.5.30 Aspect

Face down the general slope and a compass bearing will give you the aspect.

23.5.31 Origin

Evidence of past fires in the stand should be noted, e.g., charcoal in the ground, blackened stumps, even-aged condition. Origin from windfall is recorded only where there is evidence of large scale windfall in the past. It is doubtful whether there are any mature stands in this province which originated from cutting. Where there is no evidence from fire and the stand is not even-aged, the origin is considered to have been virgin.

23.5.32 Comments

Make note of quality of timber, reproduction, rock outcrops, gravel ridges, silvicultural treatment, logging method and economic chance.

In small timber where there is easy skidding and plentiful vigorous young growth, if logging is to be recommended, should a small tractor less than gauge 60 inches, or horses be used.

Make notes and leave nothing to memory.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

FOREST MANAGEMENT

SCALING INSTRUCTIONS FOR CUBED PULPWOOD

CHAPTER 24

JUNE, 1968

FOREST MANAGEMENT

CHAPTER 24

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CHAPTER 24

FOREST MANAGEMENT

SCALING INSTRUCTIONS FOR CUBED PULPWOOD

INTRODUCTION TO SCALING

The measurement of logs to ascertain their contents is called scaling. Scaling is not a guess but a scientific estimate based on certain fundamental rules tempered with experience.

Although there are various purposes for scaling, the main purpose of scaling is to measure the volume of the forest product being sold.

There are three general scaling methods used in Alberta:

A. By Board foot measure (International 5/16 Inch Log Rule).

B. Solid volume, the unit of measure being the cubic foot. (Alberta Cubic Foot Rule, Cubed Pulpwood Instructions).

C. Apparent volume, the unit of measure being the cord of 128 apparent cubic feet, or the equivalent of a pile of wood 4'x4'x8'. (Pulpwood Instructions - stacked wood).

REQUIREMENTS OF A SCALER

When scaling or measuring Crown timber a scaler is determining the amount of government property passing into private ownership and the amount of revenue from the sale of that property. It is his duty, holding an Alberta licence or permit to scale and being responsible to the Department, to determine these amounts fairly and accurately.

Scaling, as practised by the Department, is a measurement related to the quantity of sound merchantable wood rather than the quality. It is therefore the scaler's duty to scale in accordance with the volume of a certain product and not in relation to any particular grade of material that is produced.

The scaler must have sound and impartial judgement, confidence in that judgement and a tenacity that will withstand negative opinions, except when accompanied by substantial evidence. The scaler must base his judgement on a thorough understanding of the following factors:

A. The scaling rules and regulations governing scaling practices in the Province of Alberta. (Refer to Appendix 1 and 2).

B. In addition to being familiar with the basic procedures for scaling a scaler must be aware of any agreement stipulation that may appear in contract between the Department and a company and how they may be co-ordinated with the basic scaling procedures.

C. The defect characteristics of the different species in the area.

D. The defect characteristics of trees taken from different sites within the area. Both mechanical and pathological defects vary with the difference in sites.

E. The identification of the different tree species in the area.

Time alone does not make a scaler qualified. His training must be thorough and the results of his work accurately checked. A scaler must at all times realize that he is the Department' representative on the operation and it is his duty to report all matters of interest to the district Forest Officer. This includes matters other than scaling.

ASSURANCE TO PURCHASERS

No assurance regarding Departmental scale will be made to purchasers, except that provincial timber will be scaled in accordance with instructions for scaling, without modification because of the favourable or unfavourable market conditions or other factors which may influence the amount of recovery or even prevent the manufacture of the amounts scaled. Every effort will be made to keep the scaling practice uniform.

CHECK SCALING (This section to be used for Departmental guidance).

It is important for a scaler to realize that his work may fluctuate and to check his own work constantly. The Alberta Forest Service will conduct check scales periodically. This should be considered by the scaler as a check on his work rather than a check on his integrity.

The Department's intention is to obtain an approximate 10 percent check scale of the volume scaled by any particular scaler when volume is being used for the direct payment of dues.

When sample scaling or weight scaling is being done, the Department's aim is to obtain at least a 25 percent check scale of the samples used for conversion. In some cases where extra information is desired, a heavier check scale may be required.

A guideline of $\pm$ 2 percent has been established for the accuracy of the scale, however, no definite figure can be fixed as a much less variation may be expected from sound timber and ideal conditions while a higher percentage may be permissible in cases where large cull factors and poor conditions occur.

When the variation exceeds $\pm$ 2 percent the check scaler shall determine if the variation is acceptable.

In pulpwood scaling it is necessary that all check scaling be done on the same side as the original scale.

24.1 PULPWOOD SCALING PROCEDURES (CUBIC FOOT SCALING)

24.1.1 Method of Scaling

In cubic scaling each individual piece of wood in a pile is tallied and expressed in cubic feet. This method of measure is generally used for measurement of stacked pulpwood over eight feet in length, for establishing the accuracy of the stack pulpwood scale, or for measuring the cubic volume of samples for weight or sample scaling conversions.

24.1.2 Unit of Measure - Cubic Foot

A cubic foot is a solid piece of wood 1 foot wide, 1 foot thick and 1 foot long. In the scaling of pulpwood the term cubic foot may be converted to cords. For conversion purposes 85 cubic feet of solid wood will be considered equal to one cord of rough stacked volume (128 cubic feet).

24.1.3 Scaling Procedure

In cubic scaling all measurements are taken from one side of the pile only as it is assumed that there is an equal distribution of butts, tops, defects, culls and voids on both sides. Defects are considered as extending through the full length of the bolt.

If it appears that one side of a row of piles has a predominance of butts, defects or voids, it should be scaled on alternate sides from one pile to the other so as to obtain a fair scale.

24.1.4 Numbering and Marking

Each pile shall be stamped or marked and shall display the road or block number, pile or sample number and the scaler's initials. Piles shall be numbered consecutively from 1 - 10,000 and then prefixed by a letter. eg. A1 - A10,000.

Sample piles for weight conversions may be designated by the random load number from an authorized table of random numbers.

In cubic scaling the following applies in regard to marking of piles:

A. As the bolts are measured and tallied they are marked by placing an "S" on the measured end.

B. Pieces that are cull will be designated by an "X" written across the end of the bolt and tallied by pieces.

C. A ring will be drawn around or beside all defects for which deductions have been made.

D. The Alberta Forest Service reserves for its own exclusive use red crayon or red colors and no unauthorized person shall use this color for marking and scaling on any logs or pulpwood bolts.

24.1.5 Measuring Lengths of Bolts

The length of bolts in cubic scaling should be measured frequently enough to make sure the "Broomage" allowance is not being exceeded.

When trees are properly bucked in prescribed lengths of 50" or 100" bolts starting from the butt, any top bolts less than 50" long will be disregarded.

Top bolts over 50" long will be scaled to next foot after "Broomage Allowance" has been considered.

i.e. A bolt 6" diameter and 5'8" long would be scaled as a 6" diameter, 6' long bolt = 1.18 cubic feet (see Table 2).

When trees are improperly bucked, (e.g. measured from the top down rather than upwards from the butt), bolts over 24" long will be scaled to the next foot in length after "Broomage Allowance" has been considered.

24.1.6 "Broomage" Allowance

An allowance of one inch in two feet for "Broomage" on all pulpwood bolts is made to compensate for damage to the ends, thus a four foot bolt is legally cut at fifty inches and an eight foot bolt cut at one hundred inches. Where bolts are found to have been cut longer than the length allowed for broomage a percentage of the total cordage in the pile is added for each inch of over-length. (Refer to Table 4).

24.1.7 Species

All material is tallied by species unless otherwise authorized. Deductions may be tallied by pieces regardless of species.

24.1.8 Tally Procedure - (Cubic Scale)

As the measurements are taken on butt or tops along one side of the pile, they are tallied by the dot-dash system in which bolts are entered in the proper inch class first by dots, then by dashes, finally making a closed, crossed square when the count reaches 10 as shown below:

No. Items	1	2	3	4	5	6	7	8	9	10
Score	.	..	.:	::	::	::	::	::	::	::

Pile No. _____ ALBERTA FOREST SERVICE Form No. FM 26

Licence, Permit or Agreement Area _____ Pulpwood Cubic Scale Date _____ 19 _____

Forest _____ 8 Foot Lengths Scaler _____

Dia	PINE	Pcs	Cu Ft	Vol.	SPRUCE	Pcs	Cu Ft	Vol.		Pcs	Cu Ft	Vol.	Deductions				
													Dia	Tally	Pcs	Cu Ft	Vol.
2			.22				.22				.22		2			.22	
3			.39				.39				.39		3		3	.61	1.83
4		5	.79	3.95		2	.79	1.58			.79		4			.70	
5		17	1.09	18.53		2	1.09	2.18			1.09		5		1	1.09	1.09
6		33	1.57	51.81			1.57				1.57		6			1.57	
7		21	2.14	44.94			2.14				2.14		7		1	2.14	2.14
8		12	2.79	33.48		1	2.79	2.79			2.79		8			2.79	
9			3.53			1	3.53	3.53			3.53		9			3.53	
10			4.36				4.36				4.36		10		1	4.36	4.36
11			5.28				5.28				5.28		11			5.28	
12			6.28				6.28				6.28		12			6.28	
13			7.37				7.37				7.37		13			7.37	
14			8.55				8.55				8.55		14			8.55	
15			9.82				9.82				9.82		15			9.82	
16			11.17				11.17				11.17		16			11.17	
17			12.61				12.61				12.61		17			12.61	
18			14.14				14.14				14.14		18			14.14	
	TOTALS	88		152.71		6		10.08							6		9.42

Gross Cu. Ft. 162.79 - Deductions 9.42 = Net Cu. Ft. 153.37 = 1.80 Net Cords

NOTE FOLLOWING DEDUCTIONS

3 irregular defects (Fig. 10)

Circular defect (Fig. 8)

Defective ring (Fig. 9)

Cull deduction (Fig. 7)

FIGURE 1 (Form No. FM 26)

An example of a completed cubic scale card for 8' wood. Similar forms containing the same information may be used.

Example: Suppose pile has the following pieces: 5 - 4" bolts, 16 - 5" bolts, 33 - 6" bolts, 21 - 7" bolts, 12 - 8" bolts, all pine; 2 - 4" bolts, 2 - 5" bolts, 1 - 8" bolt, 1 - 9" bolt, all spruce. Tally bolts as shown.

Pile No. _____ ALBERTA FOREST SERVICE

Licence, Permit or Agreement Area _____ Pulpwood Cubic Scale Date _____ 19 _____

Forest _____ Length _____ Scaler _____

Dia		Pcs	Cu Ft	Vol.		Pcs	Cu Ft	Vol.		Pcs	Cu Ft	Vol.	Deductions				
													Dia	Tally	Pcs	Cu Ft	Vol.
2													2				
3													3				
4													4				
5													5				
6													6				
7													7				
8													8				
9													9				
10													10				
11													11				
12													12				
13													13				
14													14				
15													15				
16													16				
	TOTALS																

Gross Cu. Ft. _____ – Deductions _____ = Net Cu. Ft. _____ = _____ Net Cords

85

FIGURE 1 (a)

Reverse side of Form FM 26 may be used when wood is other than 8' length.

24.1.9 Pulpwood Scaling Stick

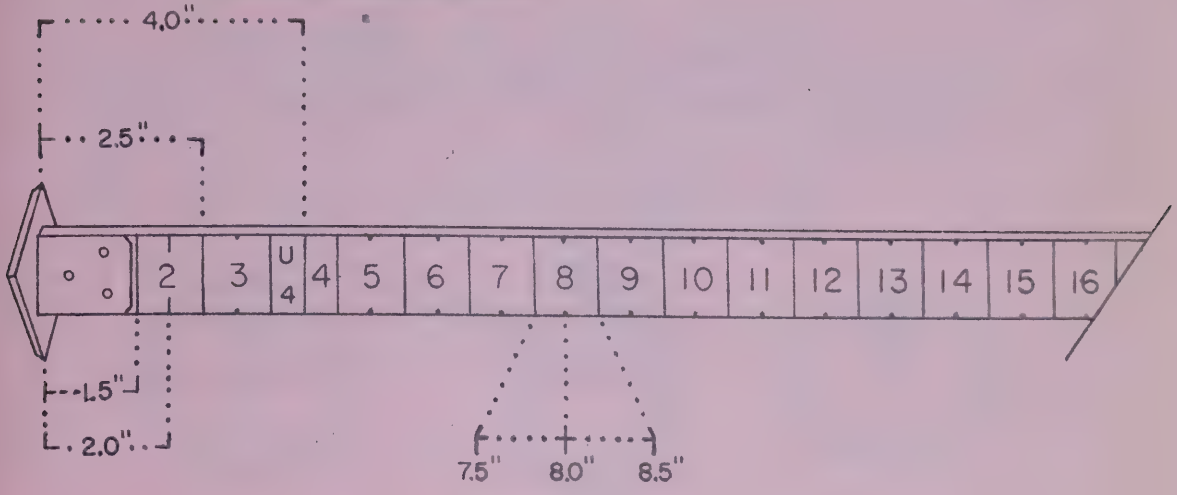


FIGURE 2

The pulpwood cube scaling stick shown in Figure 2 is graduated by diameter classes. Sticks graduated by diameter classes differ from ordinary rules by the fact that the lines are placed on the 1/2 inch mark.

i.e.: An 8" diameter class has calibrations at 7.5" and 8.5". In scaling pulpwood bolts any measurement that falls between the two lines would be called 8".

The above rule is also calibrated for the utilization standard of green pulpwood having a class (u4) for bolts under 4.0" and a class of (4) inches for bolts from 4.0" to 4.5".

Sticks may be calibrated to any size, usually 24 inches.

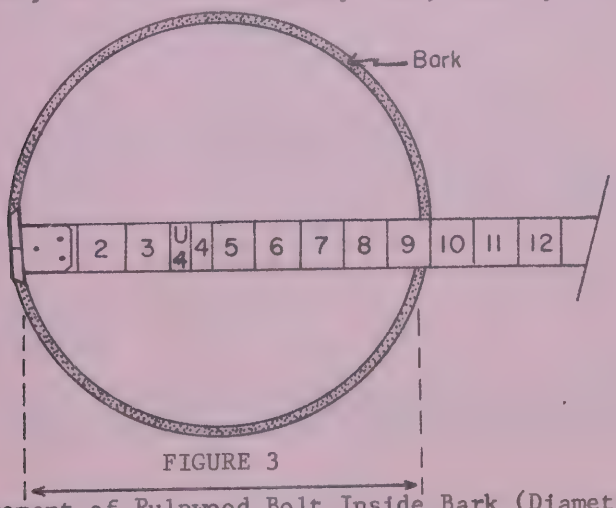


FIGURE 3

Measurement of Pulpwood Bolt Inside Bark (Diameter 9 Inches)

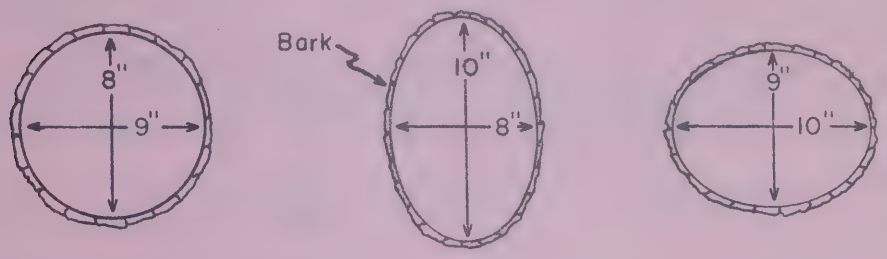
24.1.10 Measuring Diameters

The top diameter inside bark is measured in inches to the nearest inch, inside bark. For example, a diameter which measured within 11.6 inches to 12.5 inches would be scaled as a 12 inch diameter. If the log is exactly round only one measurement is required.

It is common to find that ends of logs being measured have an oval rather than circular shape. The scaling diameter of an oval shaped log is taken as the average of the maximum and minimum diameter classes found by measuring respectively across the widest and narrowest faces of the log being measured.

If the average of two diameter classes comes to a figure with a half-inch (for example, 12 + 15 = 27 ÷ 2 = 13.5), the closest even figure is taken as the diameter for scaling. That is,

12" + 15" = 27" ÷ 2 = 13.5" will be taken as 14"
12" + 13" = 25" ÷ 2 = 12.5" will be taken as 12"



Diameter taken as 8" | Diameter taken as 9" | Diameter taken as 10"

$\frac{8+9}{2} = \frac{17}{2} = 8.5$ to 8" $\quad \frac{8+10}{2} = \frac{18}{2} = 9$" $\quad \frac{10+9}{2} = \frac{19}{2} = 9.5$ to 10"

FIGURE 4

Top Diameter Measurements

In obtaining the average diameter of bolts care should be taken to ignore slight abnormal swellings. For instance in figure 5, BC rather than AC should be taken in determining the diameter. The average diameter would be 14 + 17 = 31 ÷ 2 = 15.5. Taken to the even inch the bolt would be scaled as 16 inches.

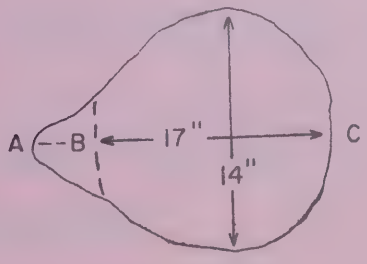


FIGURE 5

Abnormal Swelling

24.1.11 Butt Diameter

In the case of butt logs with excessive flare, the butt diameters are reduced to provide for normal taper only.

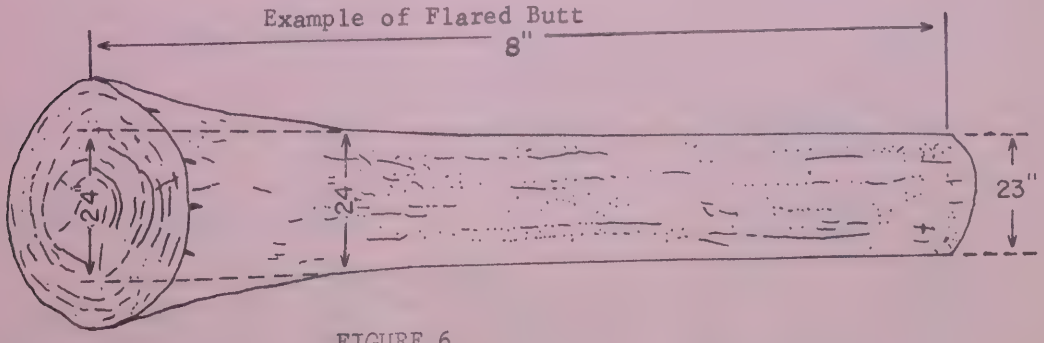


FIGURE 6

Butts with definite flare are measured by projection of the line of normal taper of the bolt to the base of the bolt.

24.1.12 Deductions

In pulpwood scaling when a defect is observed on the end of a bolt it is assumed that it extends the full length of the bolt and deductions are made accordingly.

No deductions are made for defects two inches in diameter or less.

No deductions are made for stain or discoloration. "Buttermilk" rot is deductible although the stages of the disease leading up to this condition are not deductible.

Sound, dry timber is acceptable for pulpwood, and should receive full scale.

In cubic scaling of pulpwood, deductions are expressed and recorded as diameters.

Deductions for a few common types of defects are as follows:

24.1.12.1 Culls

A pulpwood bolt is considered a cull when more than 50% of its volume is defective.

In cubic scale, the method of determining culls is to square the diameter of the defect and if it is more than half the square of the diameter of the bolt it must be culled.

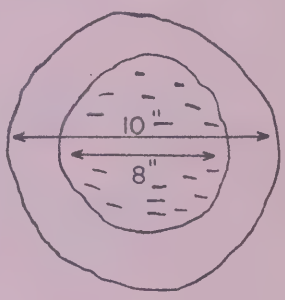


FIGURE 7
Cull Deduction

i.e. Diameter of bolt squared = 10x10 = 100
Diameter of defect squared = 8x8 = 64

As 64 is more than half of 100 the bolt is considered as a cull and recorded as a piece. (Tally as 10" deduction - See Figure 1).

24.1.12.2 Circular Defect

Diameter of defect is measured and tallied in inches. (5" deduction - See Figure 1).

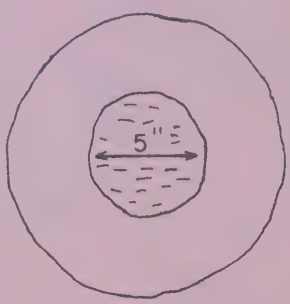
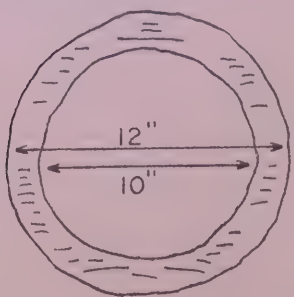


FIGURE 8
Circular Defect

24.1.12.3 Defective Ring

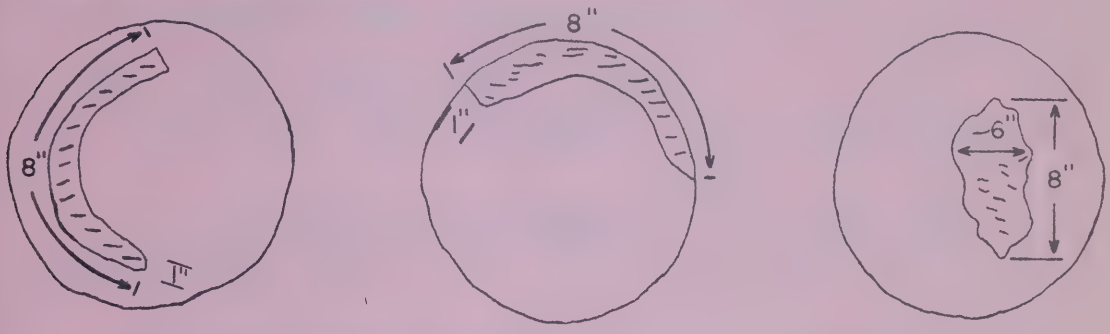
Square the diameter of the surface. Square the diameter of the sound wood, then take the square root of the difference of the diameters square to find the diameter corresponding to the defect.



i.e. 12 x 12 = 144
10 x 10 = 100
44

24.1.12.4 Irregular Shaped Defects

Defects irregular in form are converted to a circle whose surface is equivalent to that of the defects. To obtain this diameter, multiply the great axis of the defect by the small axis, take the square root of the product, the result being the diameter of the defect.



i.e. $\sqrt{1 \times 8} = \sqrt{8} = 3"$ i.e. $\sqrt{8 \times 6} = \sqrt{48} = 7"$

FIGURE 10

(Tally as 3" deduction - See Figure 1)

24.1.12.5 Scattered Defects

If the defects are circular in form, the square root of the sum of the diameter squared is obtained, the result being the diameter of the single defect to be deducted.

If the defects are irregular in form, the square root of the sum of the product of the axis is obtained to find the diameter of the single defect to be deducted.

i.e. $\sqrt{(5)^2 + (6)^2 + (6 \times 10)}$

$= \sqrt{25 + 36 + 60}$

$= \sqrt{121} = 11$ inches

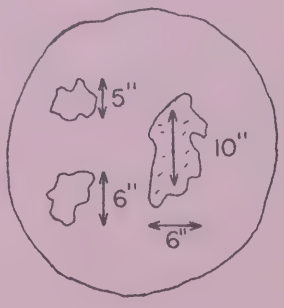


FIGURE 11

24.1.13 Utilization Limits

In cubic scaling bolts under 4.0 inches are tallied however, since green pulpwood is utilized to a 4 inch top bolts under 4.0 inches in diameter inside the bark at the top end must be deleted from the gross scale to arrive at the net scale. Of course deductions are not assessed on bolts which are to be deleted from the scale.

24.2 PULPWOOD SCALING THEORY (CUBIC FOOT SCALING)

The volume of a cubed bolt of pulpwood is determined by the following formula:

Volume in cubic feet = $D^2 \times 0.005454154 \times L.$

D equals diameter of piece or defect in inches

L equals length of piece or defect in feet.

$\pi = 3.1415926536; \quad \frac{\pi}{4} = .7853981634; \quad \frac{\pi}{4 \times 144} = 0.005454154$

In calculating the above formula for Table 1, the basal area for inches as shown in Table 1 was used and multiplied by all lengths.

For conversion purposes from cubic feet of solid wood to stacked cords, 85 cubic feet of solid wood is considered equal to one cord of 128 cubic feet, stacked volume. (Rough, not peeled).

Table 2

Volumes in Solid cubic Feet for one inch diameter classes

Length in Foot

Diameter Class	2	3	4	5	6	7	8	9	10
4.25	.20	.30	.39	.49	.59	.69	.79	.89	.99
5	.27	.41	.55	.68	.82	.95	1.09	1.23	1.36
6	.39	.59	.79	.98	1.18	1.37	1.57	1.77	1.96
7	.53	.80	1.07	1.34	1.60	1.87	2.14	2.41	2.67
8	.70	1.05	1.40	1.75	2.09	2.44	2.79	3.14	3.49
9	.88	1.32	1.77	2.21	2.65	3.09	3.53	3.98	4.42
10	1.09	1.64	2.18	2.73	3.27	3.82	4.36	4.91	5.45
11	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60
12	1.57	2.36	3.14	3.93	4.71	5.50	6.28	7.07	7.85
13	1.84	2.76	3.69	4.61	5.53	6.45	7.37	8.30	9.22
14	2.14	3.21	4.28	5.35	6.41	7.48	8.55	9.62	10.69
15	2.45	3.68	4.91	6.14	7.36	8.59	9.82	11.04	12.27
16	2.79	4.19	5.59	6.98	8.38	9.77	11.17	12.57	13.96
17	3.15	4.73	6.31	7.88	9.46	11.03	12.61	14.19	15.76
18	3.53	5.30	7.07	8.84	10.60	12.37	14.14	15.90	17.67
19	3.94	5.91	7.88	9.84	11.81	13.78	15.75	17.72	19.69
20	4.36	6.54	8.73	10.91	13.09	15.27	17.45	19.63	21.82
21	4.81	7.22	9.62	12.03	14.43	16.84	19.24	21.65	24.05
22	5.28	7.92	10.56	13.20	15.84	18.48	12.12	23.76	26.40
23	5.77	8.66	11.54	14.43	17.31	20.20	23.08	25.97	28.85
24	6.28	9.42	12.57	15.71	18.85	21.99	25.13	28.27	31.42
25	6.82	10.23	13.64	17.04	20.45	23.86	27.27	30.68	34.09
26	7.37	11.06	14.75	18.44	22.12	25.81	29.50	33.18	36.87
27	7.95	11.93	15.90	19.88	23.86	27.83	31.81	35.78	39.76
28	8.55	12.83	17.10	21.38	25.66	29.93	34.21	38.48	42.76
29	9.17	13.76	18.35	22.93	27.52	32.11	36.70	41.28	45.87
30	9.82	14.73	19.63	24.54	29.45	34.36	39.27	44.18	49.09
31	10.48	15.72	20.97	26.21	31.45	36.69	41.93	47.17	52.41
32	11.17	16.76	22.34	27.93	33.51	39.10	44.68	50.27	55.85
33	11.88	17.82	23.76	29.70	35.64	41.58	47.52	53.46	59.40
34	12.61	18.92	25.22	31.53	37.83	44.14	50.44	56.75	63.05
35	13.36	20.04	26.73	33.41	40.09	46.77	53.45	60.13	66.81
36	14.14	21.20	28.27	35.34	42.41	49.48	56.55	63.62	70.69
37	14.93	22.40	29.87	37.33	44.80	52.27	59.73	67.20	74.67
38	15.75	23.63	31.50	39.38	47.25	55.13	63.01	70.88	78.76
	2	3	4	5	6	7	8	9	10

Class Limits: 5" class = 4.6" - 5.5" inclusive
4.25" class = 4.0" - 4.5" inclusive

Table 3

Accumulative Volumes in Solid Cubic Feet For
(8' Bolts)

2.0" - 2.5"

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	.22	26	5.72
2	.44	27	5.94
3	.66	28	6.16
4	.88	29	6.38
5	1.10	30	6.60
6	1.32	31	6.82
7	1.54	32	7.04
8	1.76	33	7.26
9	1.98	34	7.48
10	2.20	35	7.70
11	2.42	36	7.92
12	2.64	37	8.14
13	2.86	38	8.36
14	3.08	39	8.58
15	3.30	40	8.80
16	3.52	41	9.02
17	3.74	42	9.24
18	3.96	43	9.46
19	4.18	44	9.68
20	4.40	45	9.90
21	4.62	46	10.12
22	4.84	47	10.34
23	5.06	48	10.56
24	5.28	49	10.78
25	5.50	50	11.00

Accumulative Volumes in Solid Cubic Feet For
(8' Bolts)

3" Diameter Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	.39	26	10.14	51	19.89	76	29.64
2	.78	27	10.53	52	20.28	77	30.03
3	1.17	28	10.92	53	20.67	78	30.42
4	1.56	29	11.31	54	21.06	79	30.81
5	1.95	30	11.70	55	21.45	80	31.20
6	2.34	31	12.09	56	21.84	81	31.59
7	2.73	32	12.48	57	22.23	82	31.98
8	3.12	33	12.87	58	22.62	83	32.37
9	3.51	34	13.26	59	23.01	84	32.76
10	3.90	35	13.65	60	23.40	85	33.15
11	4.29	36	14.04	61	23.79	86	33.54
12	4.68	37	14.43	62	24.18	87	33.93
13	5.07	38	14.82	63	24.57	88	34.32
14	5.46	39	15.21	64	24.96	89	34.71
15	5.85	40	15.60	65	25.35	90	35.10
16	6.24	41	15.99	66	25.74	91	35.49
17	6.63	42	16.38	67	26.13	92	35.88
18	7.02	43	16.77	68	26.52	93	36.27
19	7.41	44	17.16	69	26.91	94	36.66
20	7.80	45	17.55	70	27.30	95	37.05
21	8.19	46	17.94	71	27.69	96	37.44
22	8.58	47	18.33	72	28.08	97	37.83
23	8.97	48	18.72	73	28.47	98	38.22
24	9.36	49	19.11	74	28.86	99	38.61
25	9.75	50	19.50	75	29.25	100	39.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) u4 Class 3.5 - 4.0"

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	.61	26	15.86	51	31.11	76	46.36
2	1.22	27	16.47	52	31.72	77	46.97
3	1.83	28	17.08	53	32.33	78	47.58
4	2.44	29	17.69	54	32.94	79	48.19
5	3.05	30	18.30	55	33.55	80	48.80
6	3.66	31	18.91	56	34.16	81	49.41
7	4.27	32	19.52	57	34.77	82	50.02
8	4.88	33	20.13	58	35.38	83	50.63
9	5.49	34	20.74	59	35.99	84	51.24
10	6.10	35	21.35	60	36.60	85	51.85
11	6.71	36	21.96	61	37.21	86	52.46
12	7.32	37	22.57	62	37.82	87	53.07
13	7.93	38	23.18	63	38.43	88	53.68
14	8.54	39	23.79	64	39.04	89	54.29
15	9.15	40	24.40	65	39.65	90	54.90
16	9.76	41	25.01	66	40.26	91	55.51
17	10.37	42	25.62	67	40.87	92	56.12
18	10.98	43	26.23	68	41.48	93	56.73
19	11.59	44	26.84	69	42.09	94	57.34
20	12.20	45	27.45	70	42.70	95	57.95
21	12.81	46	28.06	71	43.31	96	58.56
22	13.42	47	28.67	72	43.92	97	59.17
23	14.03	48	29.28	73	44.53	98	59.78
24	14.64	49	29.89	74	45.14	99	60.39
25	15.25	50	30.50	75	45.75	100	61.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 4" + Class 4.0" - 4.5"

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	.79	26	20.54	51	40.29	76	60.04
2	1.58	27	21.33	52	41.08	77	60.83
3	2.37	28	22.12	53	41.87	78	61.62
4	3.16	29	22.91	54	42.66	79	62.41
5	3.95	30	23.70	55	43.45	80	63.20
6	4.74	31	24.49	56	44.24	81	63.99
7	5.53	32	25.28	57	45.03	82	64.78
8	6.32	33	26.07	58	45.82	83	65.57
9	7.11	34	26.86	59	46.61	84	66.36
10	7.90	35	27.65	60	47.40	85	67.15
11	8.69	36	28.44	61	48.19	86	67.94
12	9.48	37	29.23	62	48.98	87	68.73
13	10.27	38	30.02	63	49.77	88	69.52
14	11.06	39	30.81	64	50.56	89	70.31
15	11.85	40	31.60	65	51.35	90	71.10
16	12.64	41	32.39	66	52.14	91	71.89
17	13.43	42	33.18	67	52.93	92	72.68
18	[illegible]	43	33.97	68	53.72	93	73.47
[illegible]	[illegible]	44	34.76	69	54.51	94	74.26
20	[illegible]	45	35.55	70	55.30	95	75.05
[illegible]	16.59	46	36.34	71	56.09	96	75.84
2[illegible]	17.38	47	37.13	72	56.88	97	76.63
[illegible]	[illegible]	48	37.92	73	57.67	98	77.42
24	[illegible]	49	38.71	74	58.46	99	78.21
25	19.[illegible]	50	39.50	75	59.25	100	79.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 4" Class - 3.5"-4.5"

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	.70	26	18.20	51	35.70	76	53.20
2	1.40	27	18.90	52	36.40	77	53.90
3	2.10	28	19.60	53	37.10	78	54.60
4	2.80	29	20.30	54	37.80	79	55.30
5	3.50	30	21.00	55	38.50	80	56.00
6	4.20	31	21.70	56	39.20	81	56.70
7	4.90	32	22.40	57	39.90	82	57.40
8	5.60	33	23.10	58	40.60	83	58.10
9	6.30	34	23.80	59	41.30	84	58.80
10	7.00	35	24.50	60	42.00	85	59.50
11	7.70	36	25.20	61	42.70	86	60.20
12	8.40	37	25.90	62	43.40	87	60.90
13	9.10	38	26.60	63	44.10	88	61.60
14	9.80	39	27.30	64	44.80	89	62.30
15	10.50	40	28.00	65	45.50	90	63.00
16	11.20	41	28.70	66	46.20	91	63.70
17	11.90	42	29.40	67	46.90	92	64.40
18	12.60	43	30.10	68	47.60	93	65.10
19	13.30	44	30.80	69	48.30	94	65.80
20	14.00	45	31.50	70	49.00	95	66.50
21	14.70	46	32.20	71	49.70	96	67.20
22	15.40	47	32.90	72	50.40	97	67.90
23	16.10	48	33.60	73	51.10	98	68.60
24	16.80	49	34.30	74	51.80	99	69.30
25	17.50	50	35.00	75	52.50	100	70.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 5" Diameter Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	1.09	26	28.34	51	55.59	76	82.84
2	2.18	27	29.43	52	56.68	77	83.93
3	3.27	28	30.52	53	57.77	78	85.02
4	4.36	29	31.61	54	58.86	79	86.11
5	5.45	30	32.70	55	59.95	80	87.20
6	6.54	31	33.79	56	61.04	81	88.29
7	7.63	32	34.88	57	62.13	82	89.38
8	8.72	33	35.97	58	63.22	83	90.47
9	9.81	34	37.06	59	64.31	84	91.56
10	10.90	35	38.15	60	65.40	85	92.65
11	11.99	36	39.24	61	66.49	86	93.74
12	13.08	37	40.33	62	67.58	87	94.83
13	14.17	38	41.42	63	68.67	88	95.92
14	15.26	39	42.51	64	69.76	89	97.01
15	16.35	40	43.60	65	70.85	90	98.10
16	17.44	41	44.69	66	71.94	91	99.19
17	18.53	42	45.78	67	73.03	92	100.28
18	19.62	43	46.87	68	74.12	93	101.37
19	20.71	44	47.96	69	75.21	94	102.46
20	21.80	45	49.05	70	76.30	95	103.55
21	22.89	46	50.14	71	77.39	96	104.64
22	23.98	47	51.23	72	78.48	97	105.73
23	25.07	48	52.32	73	79.57	98	106.82
24	26.16	49	53.41	74	80.66	99	107.91
25	27.25	50	54.50	75	81.75	100	109.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 6" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	1.57	26	40.82	51	80.07	76	119.32
2	3.14	27	42.39	52	81.64	77	120.89
3	4.71	28	43.96	53	83.21	78	122.46
4	6.28	29	45.53	54	84.78	79	124.03
5	7.85	30	47.10	55	86.35	80	125.60
6	9.42	31	48.67	56	87.92	81	127.17
7	10.99	32	50.24	57	89.49	82	128.74
8	12.56	33	51.81	58	91.06	83	130.31
9	14.13	34	53.38	59	92.63	84	131.88
10	15.70	35	54.95	60	94.20	85	133.45
11	17.27	36	56.52	61	95.77	86	135.02
12	18.84	37	58.09	62	97.34	87	136.59
13	20.41	38	59.66	63	98.91	88	138.16
14	21.98	39	61.23	64	100.48	89	139.73
15	23.55	40	62.80	65	102.05	90	141.30
16	25.12	41	64.37	66	103.62	91	142.87
17	26.69	42	65.94	67	105.19	92	144.44
18	28.26	43	67.51	68	106.76	93	146.01
19	29.83	44	69.08	69	108.33	94	147.58
20	31.40	45	70.65	70	109.90	95	149.15
21	32.97	46	72.22	71	111.47	96	150.72
22	34.54	47	73.79	72	113.04	97	152.29
23	36.11	48	75.36	73	114.61	98	153.86
24	37.68	49	76.93	74	116.18	99	155.43
25	39.25	50	78.50	75	117.75	100	157.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 7" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	2.14	26	55.64	51	109.14	76	162.64
2	4.28	27	57.78	52	111.28	77	164.78
3	6.42	28	59.92	53	113.42	78	166.92
4	8.56	29	62.06	54	115.56	79	169.06
5	10.70	30	64.20	55	117.70	80	171.20
6	12.84	31	66.34	56	119.84	81	173.34
7	14.98	32	68.48	57	121.98	82	175.48
8	17.12	33	70.62	58	124.12	83	177.62
9	19.26	34	72.76	59	126.26	84	179.76
10	21.40	35	74.90	60	128.40	85	181.90
11	23.54	36	77.04	61	130.54	86	184.04
12	25.68	37	79.18	62	132.68	87	186.18
13	27.82	38	81.32	63	134.82	88	188.32
14	29.96	39	83.46	64	136.96	89	190.46
15	32.10	40	85.60	65	139.10	90	192.60
16	34.24	41	87.74	66	141.24	91	194.74
17	36.38	42	89.88	67	143.38	92	196.88
18	38.52	43	92.02	68	145.52	93	199.02
19	40.66	44	94.16	69	147.66	94	201.16
20	42.80	45	96.30	70	149.80	95	203.30
21	44.94	46	98.44	71	151.94	96	205.44
22	47.08	47	100.58	72	154.08	97	207.58
23	49.22	48	102.72	73	156.22	98	209.72
24	51.36	49	104.86	74	158.36	99	211.86
25	53.50	50	107.00	75	160.50	100	214.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 8" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	2.79	26	72.54	51	142.29	76	212.04
2	5.58	27	75.33	52	145.08	77	214.83
3	8.37	28	78.12	53	147.87	78	217.62
4	11.16	29	80.91	54	150.66	79	220.41
5	13.95	30	83.70	55	153.45	80	223.20
6	16.74	31	86.49	56	156.24	81	225.99
7	19.53	32	89.28	57	159.03	82	228.78
8	22.32	33	92.07	58	161.82	83	231.57
9	25.11	34	94.86	59	164.61	84	234.36
10	27.90	35	97.65	60	167.40	85	237.15
11	30.69	36	100.44	61	170.19	86	239.94
12	33.48	37	103.23	62	172.98	87	242.73
13	36.27	38	106.02	63	175.77	88	245.52
14	39.06	39	108.81	64	178.56	89	248.31
15	41.85	40	111.60	65	181.35	90	251.10
16	44.64	41	114.39	66	184.14	91	253.89
17	47.43	42	117.18	67	186.93	92	256.68
18	50.22	43	119.97	68	189.72	93	259.47
19	53.01	44	122.76	69	192.51	94	262.26
20	55.80	45	125.55	70	195.30	95	265.05
21	58.59	46	128.34	71	198.09	96	267.84
22	61.38	47	131.13	72	200.88	97	270.63
23	64.17	48	133.92	73	203.67	98	273.42
24	66.96	49	136.71	74	206.46	99	276.21
25	69.75	50	139.50	75	209.25	100	279.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 9" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	3.53	26	91.78	51	180.03	76	268.28
2	7.06	27	95.31	52	183.56	77	271.81
3	10.59	28	98.84	53	187.09	78	275.34
4	14.12	29	102.37	54	190.62	79	278.87
5	17.65	30	105.90	55	194.15	80	282.40
6	21.18	31	109.43	56	197.68	81	285.93
7	24.71	32	112.96	57	201.21	82	289.46
8	28.24	33	116.49	58	204.74	83	292.99
9	31.77	34	120.02	59	208.27	84	296.52
10	35.30	35	123.55	60	211.80	85	300.05
11	38.83	36	127.08	61	215.33	86	303.58
12	42.36	37	130.61	62	218.86	87	307.11
13	45.89	38	134.14	63	222.39	88	310.64
14	49.42	39	137.67	64	225.92	89	314.17
15	52.95	40	141.20	65	229.45	90	317.70
16	56.48	41	144.73	66	232.98	91	321.23
17	60.01	42	148.26	67	236.51	92	324.76
18	63.54	43	151.79	68	240.04	93	328.29
19	67.07	44	155.32	69	243.57	94	331.82
20	70.60	45	158.85	70	247.10	95	335.35
21	74.13	46	162.38	71	250.63	96	338.88
22	77.66	47	165.91	72	254.16	97	342.41
23	81.19	48	169.44	73	257.69	98	345.94
24	84.72	49	172.97	74	261.22	99	349.47
25	88.25	50	176.50	75	264.75	100	353.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) 10" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	4.36	26	113.36	51	222.36
2	8.72	27	117.72	52	226.72
3	13.08	28	122.08	53	231.08
4	17.44	29	126.44	54	235.44
5	21.80	30	130.80	55	239.80
6	26.16	31	135.16	56	244.16
7	30.52	32	139.52	57	248.52
8	34.88	33	143.88	58	252.88
9	39.24	34	148.24	59	257.24
10	43.60	35	152.60	60	261.60
11	47.96	36	156.96	61	265.96
12	52.32	37	161.32	62	270.32
13	56.68	38	165.68	63	274.68
14	61.04	39	170.04	64	279.04
15	65.40	40	174.40	65	283.40
16	69.76	41	178.76	66	287.76
17	74.12	42	183.12	67	292.12
18	78.48	43	187.48	68	296.48
19	82.84	44	191.84	69	300.84
20	87.20	45	196.20	70	305.20
21	91.56	46	200.56	71	309.56
22	95.92	47	204.92	72	313.92
23	100.28	48	209.28	73	318.28
24	104.64	49	213.64	74	322.64
25	109.00	50	218.00	75	327.00

Accumulative Volumes in Solid Cubic Feet
(8' Bolts) - 11" Class (8' Bolts) - 12" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	5.28	26	137.28	1	6.28	26	163.28
2	10.56	27	142.56	2	12.56	27	169.56
3	15.84	28	147.84	3	18.84	28	175.84
4	21.12	29	153.12	4	25.12	29	182.12
5	26.40	30	158.40	5	31.40	30	188.40
6	31.68	31	163.68	6	37.68	31	194.68
7	36.96	32	168.96	7	43.96	32	200.96
8	42.24	33	174.24	8	50.24	33	207.24
9	47.52	34	179.52	9	56.52	34	213.52
10	52.80	35	184.80	10	62.80	35	219.80
11	58.08	36	190.08	11	69.08	36	226.08
12	63.36	37	195.36	12	75.36	37	232.36
13	68.64	38	200.64	13	81.64	38	238.64
14	73.92	39	205.92	14	87.92	39	244.92
15	79.20	40	211.20	15	94.20	40	251.20
16	84.48	41	216.48	16	100.48	41	257.48
17	89.76	42	221.76	17	106.76	42	263.76
18	95.04	43	227.04	18	113.04	43	270.04
19	100.32	44	232.32	19	119.32	44	276.32
20	105.60	45	237.60	20	125.60	45	282.60
21	110.88	46	242.88	21	131.88	46	288.88
22	116.16	47	248.16	22	138.16	47	295.16
23	121.44	48	253.44	23	144.44	48	301.44
24	126.72	49	258.72	24	150.72	49	307.72
25	132.00	50	264.00	25	157.00	50	314.00

Accumulative Volumes in Solid Cubic Feet

(8' Bolts) - 13" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	7.37	26	191.62
2	14.74	27	198.99
3	22.11	28	206.36
4	29.48	29	213.73
5	36.85	30	221.10
6	44.22	31	228.47
7	51.59	32	235.84
8	58.96	33	243.21
9	66.33	34	250.58
10	73.70	35	257.95
11	81.07	36	265.32
12	88.44	37	272.69
13	95.81	38	280.06
14	103.18	39	287.43
15	110.55	40	294.80
16	117.92	41	302.17
17	125.29	42	309.54
18	132.66	43	316.91
19	140.03	44	324.28
20	147.40	45	331.65
21	154.77	46	339.02
22	162.14	47	346.39
23	169.51	48	353.76
24	176.88	49	361.13
25	184.25	50	368.50

(8' Bolts) - 14" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	8.55	26	222.30
2	17.10	27	230.85
3	25.65	28	239.40
4	34.20	29	247.95
5	42.75	30	256.50
6	51.30	31	265.05
7	59.85	32	273.60
8	68.40	33	282.15
9	76.95	34	290.70
10	85.50	35	299.25
11	94.05	36	307.80
12	102.60	37	316.35
13	111.15	38	324.90
14	119.70	39	333.45
15	128.25	40	342.00
16	136.80	41	350.55
17	145.35	42	359.10
18	153.90	43	367.65
19	162.45	44	376.20
20	171.00	45	384.75
21	179.55	46	393.30
22	188.10	47	401.85
23	196.65	48	410.40
24	205.20	49	418.95
25	213.75	50	427.50

Accumulative Volumes in Solid Cubic Feet

(8' Bolts) - 15" Class

Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	9.82	26	255.32
2	19.64	27	265.14
3	29.46	28	274.96
4	39.28	29	284.78
5	49.10	30	294.60
6	58.92	31	304.42
7	68.74	32	314.24
8	78.56	33	324.06
9	88.38	34	333.88
10	98.20	35	343.70
11	108.02	36	353.52
12	117.84	37	363.34
13	127.66	38	373.16
14	137.48	39	382.98
15	147.30	40	392.80
16	157.12	41	402.62
17	166.94	42	412.44
18	176.76	43	422.26
19	186.58	44	432.08
20	196.40	45	441.90
21	206.22	46	451.72
22	216.04	47	461.54
23	225.86	48	471.36
24	235.68	49	481.18
25	245.50	50	491.00

(8' Bolts) - 16" Class

Pcs.	Cu.Ft.
1	11.17
2	22.34
3	33.51
4	44.68
5	55.85
6	67.02
7	78.19
8	89.36
9	100.53
10	111.70
11	122.87
12	134.04
13	145.21
14	156.38
15	167.55
16	178.72
17	189.89
18	201.06
19	212.23
20	223.40
21	234.57
22	245.74
23	256.91
24	268.08
25	279.25

(8' Bolts) - 17" Class

Pcs.	Cu.Ft.
1	12.61
2	25.22
3	37.83
4	50.44
5	63.05
6	75.66
7	88.27
8	100.88
9	113.49
10	126.10
11	138.71
12	151.32
13	163.93
14	176.54
15	189.15
16	201.76
17	214.37
18	226.98
19	239.59
20	252.20
21	264.81
22	277.42
23	290.03
24	302.64
25	315.25

Accumulative Volumes in Solid Cubic Feet

(8' Bolts) - 18" Class		(8' Bolts) - 19" Class		(8' Bolts) - 20" Class	
Pcs.	Cu.Ft.	Pcs.	Cu.Ft.	Pcs.	Cu.Ft.
1	14.14	1	15.75	1	17.45
2	28.28	2	31.50	2	34.90
3	42.42	3	47.25	3	52.35
4	56.56	4	63.00	4	69.80
5	70.70	5	78.75	5	87.25
6	84.84	6	94.50	6	104.70
7	98.98	7	110.25	7	122.15
8	113.12	8	126.00	8	139.60
9	127.26	9	141.75	9	157.05
10	141.40	10	157.50	10	174.50
11	155.54	11	173.25	11	191.95
12	169.68	12	189.00	12	209.40
13	183.82	13	204.75	13	226.85
14	197.96	14	220.50	14	244.30
15	212.10	15	236.25	15	261.75
16	226.24	16	252.00	16	279.20
17	240.38	17	267.75	17	296.65
18	254.52	18	283.50	18	314.10
19	268.66	19	299.25	19	331.55
20	282.80	20	315.00	20	349.00
21	296.94	21	330.75	21	366.45
22	311.08	22	346.50	22	383.90
23	325.22	23	362.25	23	401.35
24	339.36	24	378.00	24	418.80
25	353.50	25	393.75	25	436.25

Table 4

Factors to be used in adjustment in cord volumes of rough or peeled pulpwood due to variation in bolt length.

Inches of Overlength	Percentage of Volume to be raised 4 foot length	8 foot length
1"	2.08	1.40
2"	4.16	2.08
3"	6.24	3.12
4"	8.32	4.16
5"	10.40	5.20
6"	12.50	6.25
7"	14.58	7.29
8"	16.66	8.33
9"	18.74	9.37
10"	20.81	10.41
11"	22.90	11.45
12"	25.00	12.50

Table - Factors to be used in adjustment in Cord volumes of Rough or Peeled wood due to variation in bolt length from 4 and 8 feet. Bolts cut under the prescribed length of 48" or 96" will be considered as full length bolts and no deductions will be allowed.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

DEC 1973

TIMBER MANAGEMENT

ALBERTA CUBIC FOOT SCALE

CHAPTER 25

July 1, 1973

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TIMBER MANAGEMENT

CHAPTER 25

ALBERTA CUBIC FOOT SCALE

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INTRODUCTION TO SCALING

The measurement of logs to ascertain their contents is called scaling. Scaling is not a guess but a scientific estimate based on certain fundamental rules tempered with experience.

Although there are various purposes for scaling, the main purpose of scaling is to measure the volume of the forest product being sold.

There are three general scaling methods used in Alberta:

A. By Board foot measure (International 5/16 Inch Log Rule).

B. Solid volume, the unit of measure being the cubic foot. (Alberta Cubic Foot Rule, Cubed Pulpwood Instructions).

C. Apparent volume, the unit of measure being the cord of 128 apparent cubic feet, or the equivalent of a pile of wood 4 ft. x 4 ft. x 8 ft. (Pulpwood Instructions – stacked wood).

REQUIREMENTS OF A SCALER

When scaling or measuring Crown timber a scaler is determining the amount of government property passing into private ownership and the amount of revenue from the sale of that property. It is his duty, holding an Alberta licence or permit to scale and being responsible to the Department, to determine these amounts fairly and accurately.

Scaling, as practised by the Department, is a measurement related to the quantity of sound merchantable wood rather than the quality. It is therefore the scaler's duty to scale in accordance with the volume of a certain product and not in relation to any particular grade of material that is produced.

The scaler must have sound and impartial judgement, confidence in that judgement and an ability to withstand negative opinions, except when accompanied by substantial evidence. The scaler must base his judgement on a thorough understanding of the following factors:

A. The scaling rules and regulations governing scaling practices in the Province of Alberta.

B. In addition to being familiar with the basic procedures for scaling a scaler must be aware of any agreement stipulation that may appear in contract between the Department and a company and how they may be co–ordinated with the basic scaling procedures.

C. The defect characteristics of the different species in the area.

D. The defect characteristics of trees taken from different sites within the area. Both mechanical and pathological defects vary with the difference in sites.

E. The identification of the different trees species in the area.

Time alone does not make a scaler qualified. His training must be thorough and the results of his work accurately checked. A scaler must at all times realize that he is the Department's representative on the operation and it is his duty to report all matters of interest to the district Forest Officer. This includes matters other than scaling.

ASSURANCE TO PURCHASERS

No assurance regarding Departmental scale will be made to purchasers, except that provincial timber will be scaled in accordance with instructions for scaling, without modification because of the favourable or unfavourable market conditions or other factors which may influence the amount of recovery or even prevent the manufacture of the amounts scaled. Every effort will be made to keep the scaling practice uniform.

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25.1

UNIT OF MEASURE – CUBIC FOOT

The Alberta Cubic Foot Scale is the volume of the sound wood content of a log in cubic feet after all deductions have been made for allowable defect.

A cubic foot is a solid piece of wood 1 foot wide, 1 foot thick and 1 foot long. This unit is considered to be the most accurate of those in common use. No allowance is made for sawkerf, slab, edgings, shrinkage or sawing method.

25.2

CUBIC FOOT LOG RULES

All cubic foot log rules are based on mathematical formulae. The rules most commonly used include the Huber, Smalian, Rapraeger, and Sorensen log rules.

Cubic foot log rules are based on the assumption that the log is a cylinder and therefore the volume is equal to the average basal area in square feet multiplied by the length of the log in feet. The rules vary mainly in the method used in arriving at the average basal area.

The method of cubic measurement in use in Alberta is based on the 'Smalian Formula' which determines the volume of the log from measurements of the two end diameters and the length of the log in feet. The end areas are calculated in square feet, averaged, and multiplied by the length to give the volume of the log; or the contents of the two cylinders calculated on the two end diameters, are added together and divided by two to give the volume of the log.

In scaling logs by cubic measure three measurements must be taken, viz:

(a) Top diameter in inches
(b) Butt diameter in inches
(c) Length in feet

25.3

NUMBERING OF LOGS

Every log, whether merchantable or cull must be numbered with crayon or other approved means at the time it is scaled.

The numbering of logs is essential as it permits check scaling at any time, allows a check on total pieces thus preventing the missing of logs and also is a safeguard against lax scaling as scaler is responsible for each individual log.

The Alberta Forest Service reserves for its own exclusive use red crayon or red colors and no unauthorized person shall use this color for marking and scaling on any logs.

25.4

USE OF THE TEN TIMES TABLE

To determine the cubic content of a log from the ten times table, first read off the volumes corresponding to the dimensions of the log:

(1) Top diameter and length of log
(2) Butt diameter and length of log

The addition of these two volumes when divided by two will equal ten times the volume of the log in cubic feet. Further division by ten gives the cubic contents of the log.

i.e. Suppose a log has 10 inch top. 12 inch butt and is 10 feet long.

$$\text{Volume} = \frac{54 + 78}{2} = \frac{132}{2} = \frac{66}{10} = 6.6 \text{ cubic feet}$$

The same end result can be achieved by dividing the two volumes by 20 thus eliminating one calculation.

$$\text{i.e. Volume} = \frac{54 + 78}{20} = \frac{132}{20} = 6.6 \text{ cubic feet}$$

THE ALBERTA CUBIC FOOT LOG RULE

Length of Log in Feet	10" Diam.	11" Diam.	12" Diam.	13" Diam.	14" Diam.	15" Diam
1	5.4541	6.5995	7.8540	9.2175	10.6901	12.2718
2	11	13	16	18	21	25
3	16	20	24	28	32	37
4	22	26	31	37	43	49
5	27	33	39	46	53	61
6	33	40	47	55	64	74
7	38	46	55	65	75	86
8	44	53	63	74	85	98
9	49	59	71	83	96	110
10	54	66	78	92	107	123
11	60	73	86	101	118	135
12	65	79	94	111	128	147
13	71	86	102	120	139	160
14	76	92	110	129	150	172
15	82	99	118	138	160	184
16	87	106	126	147	171	196
17	93	112	133	157	182	209
18	98	119	141	166	192	221
19	104	125	149	175	203	233
20	109	132	157	184	214	245

Figure 1

RECORDING

Cubic scale rules are worked out to one place decimals, but the actual decimal point is omitted from the rule. This makes it a 'Ten Times' rule.

All cubic scaling done with these 'Ten Times' rules are recorded as 'Ten Times'. In other words the figures are not reduced to a 'one times' until the end of each page.

When using the scale book for cubic scale, the cubic footages for both the top diameter and butt diameter are recorded in respective columns.

The columns of figures are added up and the sub-totals placed in the space allotted for them. The addition of the sub-totals is then divided by 2 and 10 (or 20), rounded off, and the result is placed in the space entitled 'Net Scale'.

In rounding off the following applies in regard to the whole number.

Figures with Decimal Fractions of .1 to .4 remain the same.

Figures with Decimal Fractions of .6 to .9 are increased by one.

Figures with Decimal Fractions of .5 are raised if last digit is odd and remain same if last digit is even.

The number of logs and net cubic footage are recorded daily in the summary in the back of the scale book or summarized for each sample load in the case of weight scaling.

Figure 2

Date _____ 19____ **34**

Species	Top No.	Top Dimensions D/L	Top Net Scale	Butt No.	Butt Dimensions D/L	Butt Net Scale
	1	10 / 10	54	1	12 / 10	78
	2	14 / 20	144	2	16 / 20	191
	3	12 / 16	110	3	14 / 16	155
	4	19 / 16	236	4	22 / 16	316
	5	10 / 22	120	5	12 / 22	173
	6	14 / 16	160	6	16 / 16	212
	7	18 / 8	106	7	20 / 8	130
	8	15 / 16	161	8	17 / 16	217
	9	20 / 22	360	9	23 / 22	490
	10	8 / 16	79	10	10 / 16	76
	11	14 / 16	150	11	16 / 16	195
	12	18 / 16	248	12	20 / 16	305
	13	7 / 36	96	13	13 / 36	332
	14			14		
	15			15		
	16			16		
	17			17		
	18			18		
	19			19		
	20			20		
	21			21		
	22			22		
	23			23		
	24			24		
	25			25		
	26			26		
	27			27		
	28			28		
	29			29		
	30			30		
		Sub-total	1994		Sub-total	2870

Top Butt

Sub-total 1994 + 2870 = 2432 Ten Times Scale

Ten Times Scale ÷ 10 = 243 Net Scale

Sound Log	25.4
Heart Rot	25.12.1(a)
Heart Rot	25.12.1(b)
Butt Rot	25.12.2
Sap Rot	25.12.3
Checks	25.12.4
Spiral Check	25.12.5
Star Check	25.12.6(a)
Star Check	25.12.6(b)
Crotch	25.12.7
Crook	25.12.8
Cat Face	25.12.9
Long Log	25.13

This figure shows a page from a cubic scale tally book (Form FM 36). In this example, deductions were subtracted from the 'Gross Scale' and net figures are entered only.

On the right hand side the various defects dealt with in this chapter are listed. The entries show how various logs should be recorded.

Figure 3

Shown below is two pages from a cubic scale tally book (Form FM 36) showing an alternate method of recording volumes. In this case diameters, lengths and cull deductions are recorded with volumes being compiled in at the end of the day.

Sound Log	25.4
Heart Rot	25.12.1 [a]
Heart Rot	25.12.1 [b]
Butt Rot	25.12.2
Sap Rot	25.12.3
Checks	25.12.4
Spiral Check	25.12.5
Star Check	25.12.6 [a]
Star Check	25.12.6 [b]
Crotch	25.12.7
Crook	25.12.8
Cat Face	25.12.9
Long Log	25.13

	Top (Gross Scale)		Butt			Species	Top (Deductions)			Butt		
No.	Dimensions D/L	Net Scale	No.	Dimensions D/L	Net Scale		No.	Dimensions D/L	Net Scale	No.	Dimensions D/L	Net Scale
1	10 10	54	1	12 10	78		1		—	1		—
2	14 20	214	2	16 20	279		2	8 20	10	2	9 20	18
3	18 16	126	3	14 16	171		3	6 8	16	3	6 8	16
4	19 16	315	4	22 16	422		4	19 4	79	4	22 4	106
5	13 22	203	5	15 22	270		5	-3" D	83	5	-3" D	97
6	14 16	171	6	16 16	223		6	10x2 8	11	6	10x2 8	11
7	18 8	141	7	20 8	174		7	¼ V	35	7	¼ V	44
8	15 16	196	8	17 16	252		8	9 8	35	8	9 8	35
9	20 22	480	9	23 22	635		9	10 22	120	9	11 22	145
10	8 16	56	10	10 16	87		10	8 2	1	10	10 2	11
11	14 16	171	11	16 16	223		11	⅛ V	21	11	⅛ V	28
12	18 16	283	12	20 16	349		12	⅛ V	35	12	⅛ V	44
13	7 36	96	13	13 36	338		13	—	—	13	—	—
14			14				14			14		
15			15				15			15		
16			16				16			16		
17			17				17			17		
18			18				18			18		
19			19				19			19		
20			20				20			20		
21			21				21			21		
22			22				22			22		
23			23				23			23		
24			24				24			24		
25			25				25			25		
26			26				26			26		
27			27				27			27		
28			28				28			28		
29			29				29			29		
30			30				30			30		
	Sub-total	2506		Sub-total	3495			Sub-total	512		Sub-total	625

$$\text{Net Scale} = \frac{6001 - 1137}{20} = 243.2 \text{ (243 Cubic Feet)}$$

25.6

SPECIES

Dues of balsam fir differ from dues of spruce, pine and douglas fir. The rate of dues for balsam fir is applicable when timber is cut under a Licence or Permit, if the timber is measured in log or tree form by a person authorized by the Director and recorded separately from the other species of timber cut.

25.7

MEASURING LOG LENGTHS

The scaler will measure the length of every log about which there is any question. In addition, the length of logs in the general run will be measured frequently enough to make sure that the specified trimming allowance is not exceeded.

When a portion of a log is unmerchantable due to its top diameter being less than the utilization requirements of a licence or agreement, the length of the log may then be reduced to where the specified minimum diameter falls.

(i.e.) If a 3 inch top occurs and the licence or agreement requires utilization to 4 ft. 0 inches, then measurement is taken at a point where 4 ft. 0 inches D.I.B. (Diameter Inside Bark) falls and the length of log reduced accordingly.

Lengths can be recorded at one foot intervals. (i.e. a 16 ft. 5 inch sawlog is recorded as a 16 ft. log.)

25.8

TRIMMING ALLOWANCES

a. Sawlogs – Trim allowance for sawlogs shall not be less than two inches or greater than six inches over the even foot. Four inches is the optimum trim.

b. Peeler Logs – Trim allowance shall not be less than six inches or greater than eight inches regardless of species.

c. Other Products – Trim allowance shall not be greater than 4 inches.

Any logs overrunning the trimming allowance will be scaled to the next foot in length (i.e. 16 ft. 7 in. sawlog is recorded as a 17 ft. log – A 8 ft. 5 inch pulpwood bolt is recorded as a 9 ft. log).

25.9

TEN TIMES SCALE STICKS

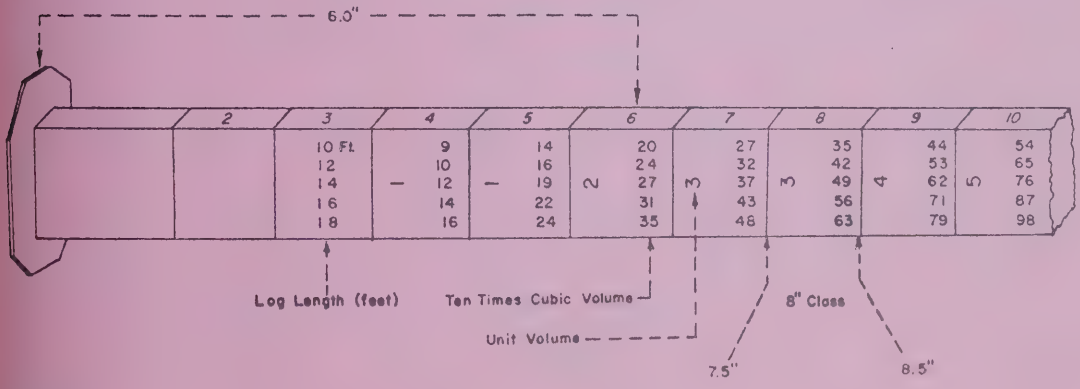


Figure 4

The 'Ten Times' scale sticks have graduations on the 1/2 inch mark as shown in the above figure. Thus measurements are taken in terms of 'inch classes'.

This 'ten times' rule also has a 'unit scale' printed along the middle of each face. It is the scale in 'ten times' of one lineal foot of a cylinder at the diameter indicated. Its use is in scaling logs one foot longer than those shown on the rule; for example, to scale a 15 foot long log the corresponding unit measurement is added to the scale of a 14 foot log of that diameter. Therefore the ten time scales for a 7 inch, 15 foot log becomes (37 + 3) = 40. This unit scale is also useful in finding deductions for defect such as one lineal foot for butt rot, etc., or two lineal feet for crooks, etc.

25.10

DIAMETER MEASUREMENTS

25.10.1

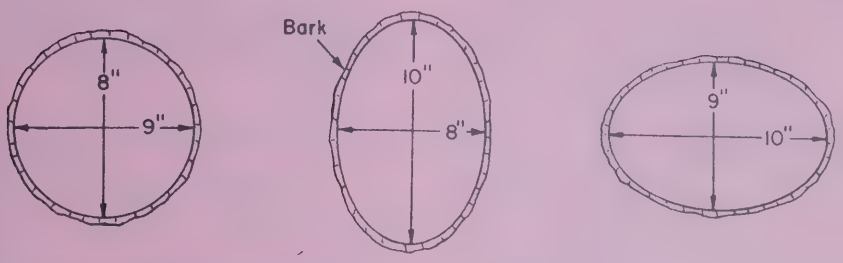
TOP DIAMETER

If the log is exactly round only one measurement is required. The top diameter is measured inside the bark to the nearest inch and recorded in that particular inch class. For example, a diameter which measures within 11.6 inches to 12.5 inches would be considered as in the 12 inch diameter class.

It is common to find that ends of logs being measured have an oval rather than circular shape. The scaling diameter of an oval shape log is taken as the average of the maximum and minimum diameter classes found by measuring respectively across the widest and narrowest faces of the log.

If the average of two diameter classes comes to a figure with a half inch (for example, 12 + 15 = 27 ÷ 2 = 13.5), the closest even figure is taken as the diameter for scaling.

Top Diameter Measurements



$\frac{8+9}{2} = \frac{17}{2} = 8.5$ to 8 in. $\frac{8+10}{2} = \frac{18}{2} = 9$ in. $\frac{10+9}{2} = \frac{19}{2} = 9.5$ to 10 in.

Figure 5

In obtaining the average diameter of bolts care should be taken to ignore slight abnormal swellings. For instance, in Figure 6, BC rather than AC should be taken in determining the diameter. The average diameter would be 14 + 17 = 31 ÷ 2 = 15.5. Taken to the even inch the bolt would be scale as 16 inches.

Abnormal Swelling

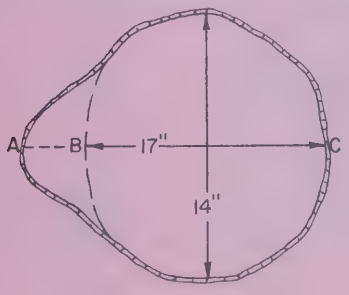


Figure 6

25.10.2

BUTT DIAMETER

In cases of butt logs with flare, the butt diameters are reduced to provide for normal taper only.

Butts with visible flare are measured by projection of the line of normal taper of the log to the base of the log. Where this is not practical, the diameter will be taken immediately above the flare.

Example of Flared Butt

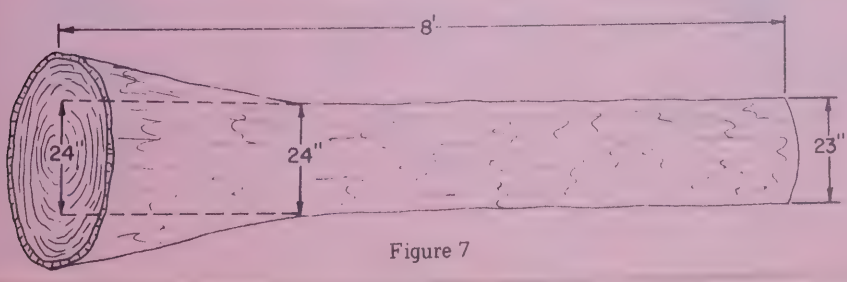


Figure 7

25.11

DEFINITION OF MERCHANTABLE AND CULL LOGS

Merchantable log means any product of the tree authorized to be cut for manufacture or sale as lumber or other product which can pay its part of the production costs from the sale of its converted product.

Cull logs are logs that contain less than 1/3 of gross contents in sound wood. Cull logs must be numbered and recorded but would show no net scale.

25.12

DEDUCTIONS

The cubic foot content of a log calculated from top and butt measurements along with the length is referred to as the 'Gross Scale'. The gross scale minus allowable deductions is referred to as the 'Net Scale'.

Deductions may be made in the following manners:

(a) Subtracting a number of feet from the length of the log.
(b) Reducing the diameter of the log.
(c) Subtracting a fraction of the gross volume.
(d) Subtracting a percentage of the gross volume.
(e) Subtracting a volume calculated under following guidelines for interior defects.

If the defect is circular, the deduction is being made as a cylinder with one inch added to the diameter of the defect to allow for marginal deterioration and marginal manufacturing loss.

If the defect is rectangular or square, deduction is made by blocking out and adding one inch to both width and height of the defect to allow for marginal deterioration and marginal manufacturing loss.

As the 'Ten Times' scale is being used deductions must be calculated and made on the same basis.

A deduction must be made for both top and butt end of the log. This apparent 'Double deduction' corrects itself when the 'double scale' is later divided by two to reduce it to a net scale.

Deductions should be made in line with the type of product being manufactured. On logs for other than sawlog or peeler use, deductions should be confined to pathological defects (rots) and missing wood (cat faces or holes).

No deductions are made for sound stained logs unless authorized by the Department. Two common types of stain may be encounted in scaling.

(1) Red stain is not considered a defect unless it has reached the soft rot stage.
(2) Blue stain generally affects sapwood on logs that have been piled for some time or on logs killed by bark beetles or fire.

No deduction will be made for mechanical defects due to poor logging practices.

Examples of allowable defects and methods of making deductions are as follows:

25.12.1

HEART ROT OR HOLE

When heart rot or a hole appears in the end of a log the volume of a cylinder 1 inch greater than the average diameter of the hole or rot shall be deducted from the volume of that end of the log.

If the hole or heart rot appears at the other end of the log a deduction for a cylinder one inch larger than the hole or rot at that end shall also be made.

The deduction shall in each case be for a cylinder corresponding to the length of the rot.

This apparent 'double deduction' corrects itself when the 'double' scale is later divided by two to reduce it to a net scale.

Example

Heart Rot (a)

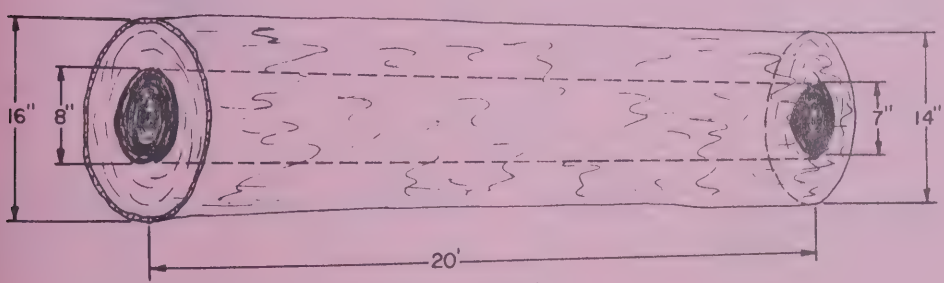


Figure 8

Log measuring 20 feet in length with top diameter of 14 inches and butt diameter of 16 inches, has heart rot averaging 7 inches at top and 8 inches at butt. Working it out, we have:

Gross Scale

Top (14 in./20 ft. log) = 214
Butt (16 in./20 ft. log) = 279
493

Deductions

Top (Heart Rot) 7 in. + 1 in./20 ft. = 70
Butt (Heart Rot) 8 in. + 1 in./20 ft. = 88
158
335

Net Scale $\frac{335}{20}$ = 16.8 = 17 cubic ft.

Heart Rot (b)

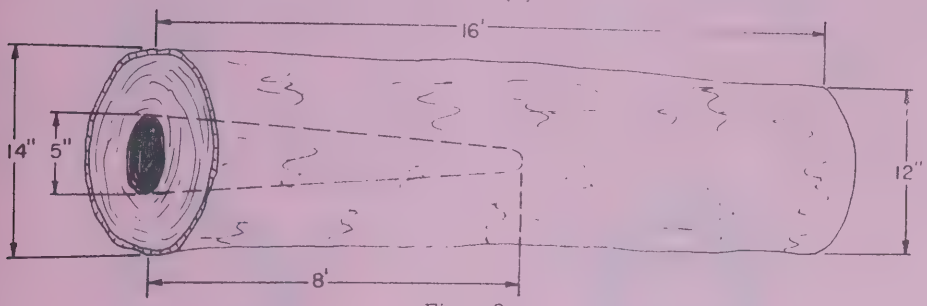


Figure 9

When heart rot or a hole appears on one end of the log proceed as follows: (assume rot is 8 foot deep)

Gross Scale

Top (12 inches/16 foot log) = 126
Butt (14 inches/16 foot log) = 171
297

Deductions

Top (Heart rot) 5 inch + 1 inch/8 foot = 16
Butt (Heart rot) 5 inch + 1 inch/8 foot = 16
32
265

Net Scale = $\frac{265}{20}$ = 13.2 = 13 Cubic Feet

25.12.2

BUTT ROT OR EXCESSIVE HEART ROT

The length of the log is reduced sufficiently to compensate for the loss of sound wood caused by the rot.

The deduction depends on how large the rot is and how far it extends into the log. If the rot is small then procedure may be same as in figure 9. The size of the rot can be seen, but only the scaler's judgement will suggest how far up the log it will probably run.

Example

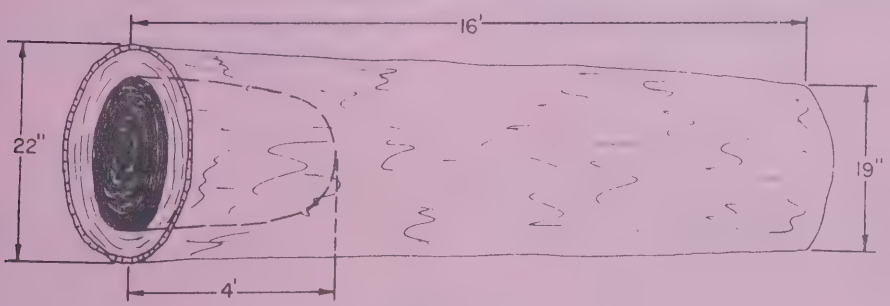


Figure 10

A log 16 feet long has a large butt rot extending an estimated 4 feet up its length.

Gross Scale

Top (19 inch/16 foot log) = 315
Butt (22 inch /16 foot log) = 422
737

Deduction

Top (19 inch/4 foot log) = 79
Butt (22 inch/4 foot log) = 106
552

Net Scale = $\frac{552}{20}$ = 27.6 = 28 Cubic Feet

25.12.3

SAP ROT

In scaling logs with sap rot the average diameter will be measured inside the rot.

Example

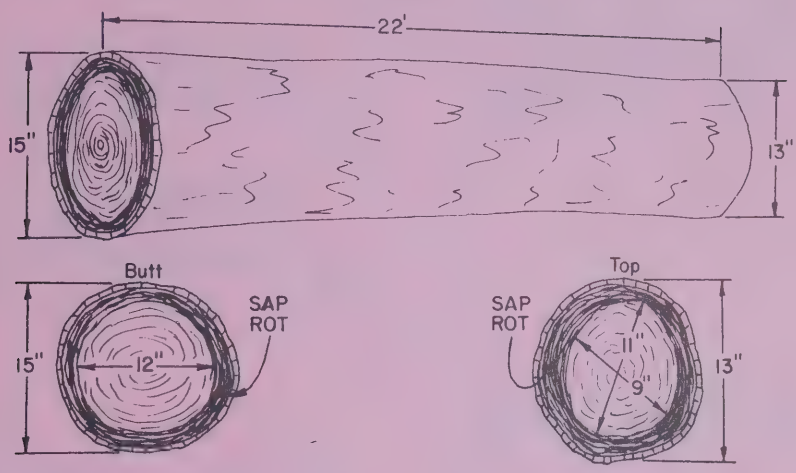


Figure 11

Gross Scale

Top (13 inch/22 foot log) = 203
Butt (15 inch/22 foot log) = 270

473

Net Scale

Top (10 inch/22 foot log) = 120
Butt (12 inch/11 foot log) = 173

293

Deduction 180

Net Scale = $\frac{293}{20}$ = 14.6 – 15 Cubic Feet

Logs having small spiral cracks on the exterior resulting from a twisted grain in the wood may be deducted in the same manner as for sap rot. It is also feasible to deduct for ring shake in the outer area by using a diameter reduction basis. This would apply where there is no recoverable wood outside the shake area.

25.12.4

SPLIT, CHECKS AND SHAKES

Split, check and shake is often twisted, and when it passes through the log and comes out at a different angle the deduction will necessarily have to be increased to allow for the loss of lumber due to short lengths.

The scaler should ignore shallow end checks that are due to unnecessary delays in presenting logs for scaling. These checks are usually very shallow and are easily cut out in the trim.

Example

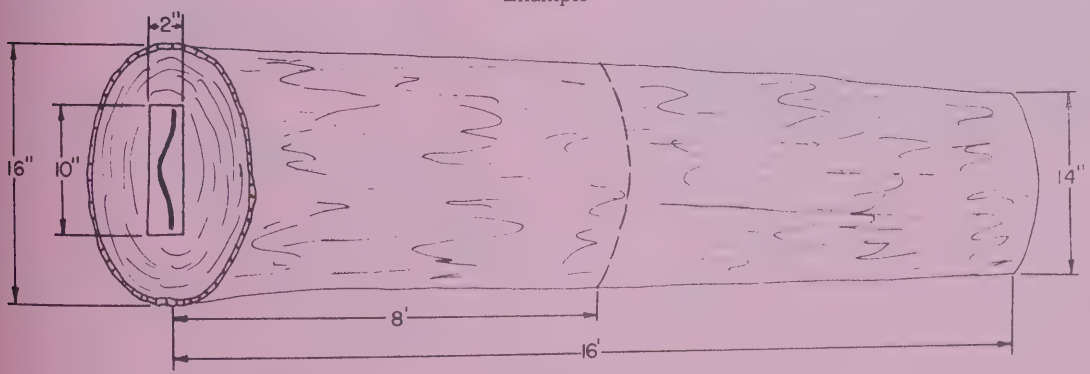


Figure 12

NOTE: One inch additions on width and height are included in the given measurements.

The example illustrates a 16 foot log with a split extending part way across the butt end and it is assumed that the split extends into the log for 8 feet. The deduction for defects of this nature should be made as follows:

Gross Scale

Top (14 in./16 ft. log) = 171
Butt (16 in./16 ft. log) = 223
394

Deductions

Top $\left(\frac{10 \text{ in. x } 2 \text{ in. x } 8 \text{ ft. x } 10}{12 \text{ x } 12}\right) = 11$
Butt $\left(\frac{10 \text{ in. x } 2 \text{ in. x } 8 \text{ ft. x } 10}{12 \text{ x } 12}\right) = 11$
22
372

Net Scale = $\frac{372}{20}$ = 18.6 19 Cubic Feet

Using the dimensions of the defect above (10 in. x 2 in. x 8 ft.), it is necessary to divide by 12 to reduce to board feet and again by 12 to reduce to cubic feet. Multiplication by 10 is necessary to make the deduction a ten times volume.

The above situation may be applied in the case of a partial ring shake by blocking out the part of the ring that is separated.

25.12.5

SPIRAL CHECK

To deduct for spiral or twisted check or split, divide the cross section of the log into sectors and deduct the fractional part enclosing the defect from the gross scale of the log.

Example

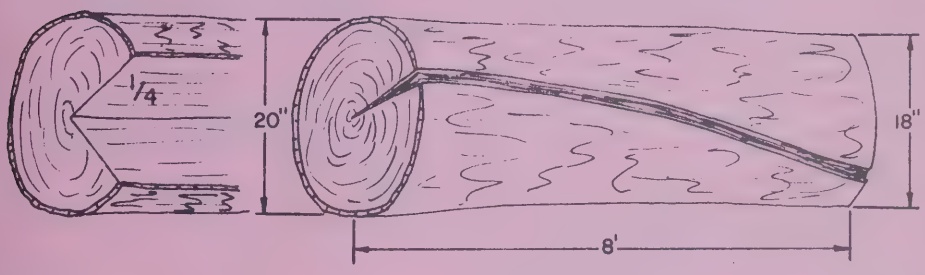


Figure 13

The defect occupies a sector equal to 1/4 of the end of the log.

Gross Scale

Top (18 in./8 ft. log) = 141
Butt (20 in./8 ft. log) = 174
315

Deductions

Top (1/4 of 141) = 35
Butt (1/4 of 174) = 44
79
236

Net Scale = $\frac{236}{20}$ = 11.8 = 12 Cubic Feet

In log or tree length logs with spiral check the amount of waste can be reduced by bucking the long logs into shorter lengths and taking out the defect as a comparatively narrow section in two or more logs rather than a larger sector in one, long log. Allowance for such defect should take this into account.

25.12.6

STAR CHECK

When star check appears on one end of the log the scaler shall estimate how far up the log the check will run. If the star check appears on both ends of the log a deduction shall in each case be for a cylinder corresponding in length to that on which the gross volume of the log is based.

Example (a)

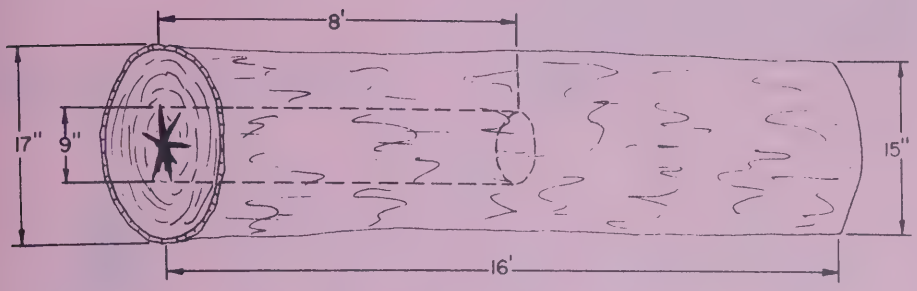


Figure 14

It is assumed that check extends 1/2 way through log in the above case.

Gross Scale

Top (15 in./16 ft. log) = 196
Butt (17 in./16 ft. log) = 252
448

Deductions

Top (8 in. + 1 in./8 ft. long)=35
Butt (8 in. + 1 in./8ft. long)=35
70
378

Net Scale = $\frac{378}{20}$ = 18.9 = 19 Cubic Feet

When star check appears on both ends of the log proceed as follows:

Example (b)

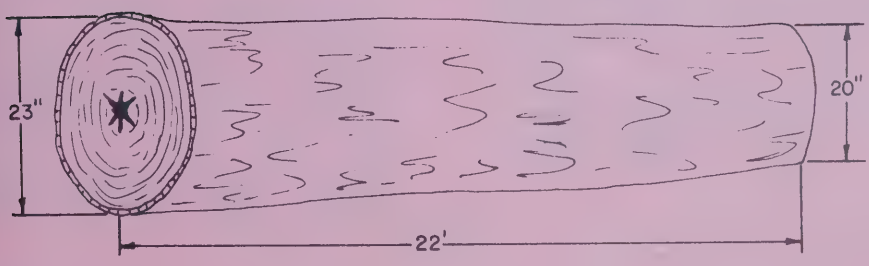


Figure 15

Gross Scale

Top (20 in./22 ft. log) = 480
Butt (23 in./22 ft. log) = 635
1115

Deductions

Top (9 in. + 1 in./22 ft. log) = 120
Butt (10 in. + 1 in./22 ft. log) = 145
265
850

Net Scale = $\frac{850}{20}$ = 42.5 = 42 Cubic Feet

25.12.7

CROTCH

In cases of logs with a crotch the measurement for the diameter should be taken immediately below the swelling. In some cases it may be more appropriate to make deductions by Fractional or percentage methods.

Example

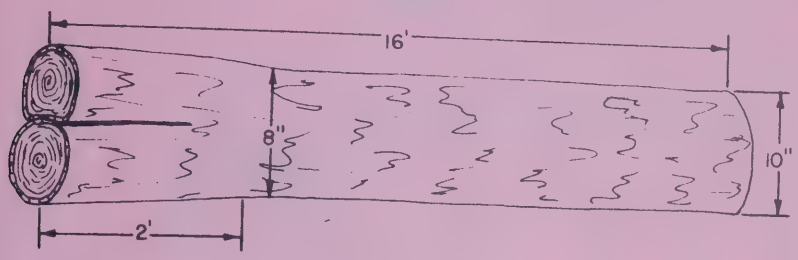


Figure 16

Gross Scale

Top (8 in./16 ft. log) = 56
Butt (10 in./16 ft. log) = 87
143

Deduction

Top (8 in./2 ft. log) = 7
Butt (10 in.2 ft. log) = 11
18
125

Net Scale = $\frac{125}{20}$ = 6.2 = 6 Cubic Feet

25.12.8

CROOK & SWEEP

Crook and sweep in logs usually can be minimized, and frequently practically eliminated by proper bucking. This is particularly true where short logs are commonly cut. Scaler must be on the alert to detect and correct continued poor bucking causing unnecessary loss from crook or sweep. If an operator persists in such practices, after adequate warning, no allowance will be made for crook or sweep until bucking is improved.

If crook or sweep occurs in long logs, allowance will be made only for so much of the defect as cannot be eliminated when dividing the log into shorter sections.

Deductions for crook or sweep are made by a reduction in length, as a percentage or as fractional reduction to volume.

Example

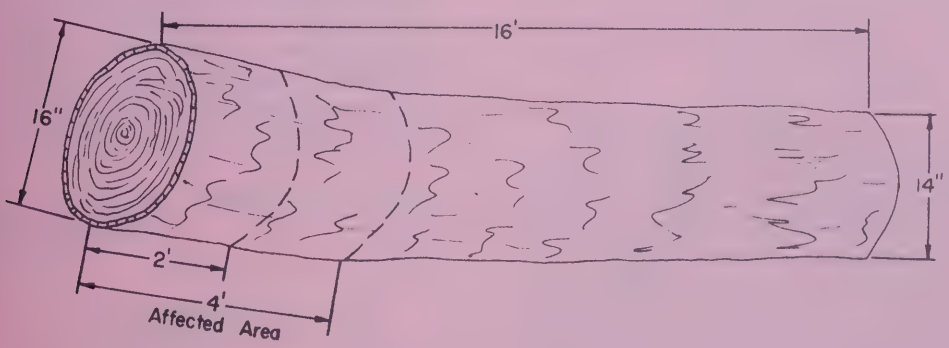


Figure 17

To take care of the loss in the above log, the length could be reduced by 2 feet which is equivalent to 12.5% or 1/8 of volume.

Gross Scale

Top (14 in./16 ft. log) = 171
Butt (16 in./16 ft. log) = 223
394

Deduction

Top (1/8 of 171) = 21
Butt (1/8 of 223) = 28
49
345

Net Scale = $\frac{345}{20}$ = 17.2 = 17 Cubic Feet

25.12.9

CAT FACE

Where defects such as cat–face, lightning scar, surface seam, or frost check occur, divide the cross–section of the log into sectors and deduct the fractional part enclosing the defect from the gross scale of the log.

Example

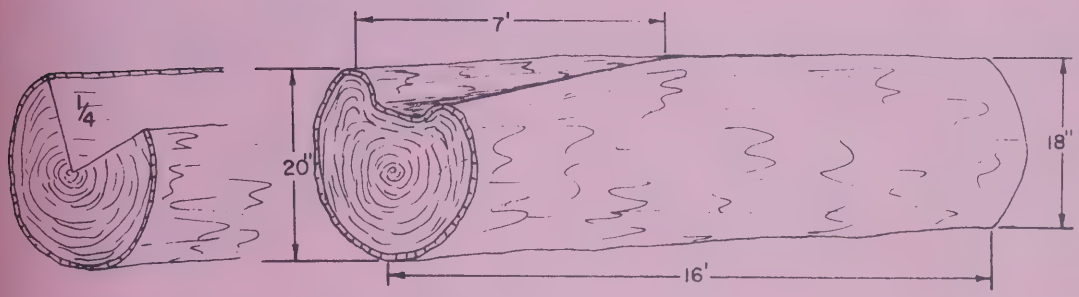


Figure 18

The defect occupies a sector equal to 1/4 of the end of the log, however, as the defect extends 1/2 the length of the log only 1/8 of the volume need be deducted.

Gross Scale

Top (18 in./16 ft. log) = 283
Butt (20 in./16 ft. log) = 349
632

Deduction

Top (1/8 of 283) = 35
Butt (1/8 of 349) = 44
553

Net Scale = $\frac{553}{20}$ = 27.6 = 28 Cubic Feet

25.13

SCALING OF LONG LOGS

Sometimes it may be necessary to scale logs exceeding top length shown on scaling stick e.g. 36 feet. The volume of such logs may be calculated by adding together the volume of any combination of two logs of equal length which added together will give the length of the log which is to be scaled.

Thus a 36 foot log could be scaled as two 18 foot logs.

Assume log with top 7 inches, Butt 13 inches and 36 feet long.

Scaled as 36 feet

Top 7 in./36 ft. = 96
Butt 13/36 = 332
Total 428

Scaled as 2 – 18 feet

Top 7 in./18 ft. = 48
Butt 13/18 = 166
Total 214

Scale = $\frac{428}{20}$ = 21.4 = 11 Cubic Feet

or $\frac{214}{10}$ = 21 Cubic Feet

When scaling long logs the prescribed trimming allowance may be permitted for each log into which the long log is divided, providing the logs will be later bucked into sawlog lengths and utilized as such.

In order to obtain a good estimate of cull, long logs containing cull should be bucked into shorter lengths until it is certain that the remaining log is sound. Cull on long logs will not be assessed for more than one 16 foot length unless logs are bucked.

(Revised Feb/75)

BASAL AREA FOR CALCULATING CUBIC FEET OF LOGS

Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.	Diameter Inches	Area Sq. ft.
1.0	.006	4.5	.110	8.0	.349	11.5	.721	15.0	1.227	18.5	1.867	22.0	2.640	25.5	3.547	29.0	4.587	42.5	9.85
.1	.007	.6	.115	.1	.358	.6	.734	.1	1.244	.6	1.887	.1	2.664	.6	3.574	.1	4.619	42.5	10.08
.2	.008	.7	.120	.2	.367	.7	.747	.2	1.260	.7	1.907	.2	2.688	.7	3.602	.2	4.650	43.5	10.32
.3	.009	.8	.126	.3	.376	.8	.759	.3	1.712	.8	1.928	.3	2.172	.8	3.631	.3	4.682	44.0	10.56
.4	.011	.9	.131	.4	.385	.9	.772	.4	2.737	.9	1.948	.4	3.659	.9	3.659	.4	4.714	44.5	10.80
1.5	.012	5.0	.136	8.5	.394	12.0	.785	15.5	1.310	19.0	1.969	22.5	2.761	26.0	3.687	29.5	4.746	45.0	11.04
.6	.014	.1	.142	.6	.403	.1	.799	.6	1.327	.1	1.990	.6	2.786	.1	3.715	.6	4.779	45.5	11.29
.7	.016	.2	.147	.7	.413	.2	.812	.7	1.344	.2	2.011	.7	2.810	.2	3.744	.7	4.811	46.0	11.54
.8	.018	.3	.153	.8	.422	.3	.825	.8	1.362	.3	2.032	.8	2.835	.3	3.773	.8	4.844	46.5	11.79
.9	.020	.4	.159	.9	.432	.4	.839	.9	1.379	.4	2.053	.9	2.860	.4	3.801	.9	4.876	47.0	12.05
2.0	.022	5.5	.165	9.0	.442	12.5	.852	16.0	1.396	19.5	2.074	23.0	2.885	26.5	3.830	30.0	4.91	47.5	12.31
.1	.024	.6	.171	.1	.452	.6	.866	.1	1.414	.6	2.095	.1	2.910	.6	3.859	30.5	5.07	48.0	12.57
.2	.026	.7	.177	.2	.462	.7	.880	.2	1.431	.7	2.117	.2	2.936	.7	3.888	31.0	5.24	48.5	12.83
.3	.029	.8	.183	.3	.472	.8	.894	.3	1.449	.8	2.138	.3	2.961	.8	3.917	31.5	5.41	49.0	13.10
.4	.031	.9	.190	.4	.482	.9	.908	.4	1.467	.9	2.160	.4	2.986	.9	3.947	32.0	5.59	49.5	13.37
2.5	.034	6.0	.196	9.5	.492	13.0	.922	16.5	1.485	20.0	2.182	23.5	3.012	27.0	3.976	32.5	5.76	50.0	13.64
.6	.037	.1	.203	.6	.503	.1	.936	.6	1.503	.1	2.204	.6	3.038	.1	4.006	33.0	5.94	50.5	13.91
.7	.040	.2	.210	.7	.513	.2	.950	.8	1.521	.2	2.226	.7	3.064	.2	4.035	33.5	6.12	51.0	14.19
.8	.043	.3	.216	.8	.524	.3	.965	.7	1.539	.3	2.248	.8	3.089	.3	4.065	34.0	6.30	51.5	14.47
.9	.046	.4	.223	.9	.535	.4	.979	.9	1.558	.4	2.270	.9	3.115	.4	4.095	34.5	6.49	52.0	14.75
3.0	.049	6.5	.230	10.0	.545	13.5	.994	17.0	1.576	20.5	2.292	24.0	3.142	27.5	4.125	35.0	6.68	52.5	15.03
.1	.052	.6	.238	.1	.556	.6	1.000	.1	1.595	.6	2.315	.1	3.168	.6	4.155	35.5	6.87	53.0	15.32
.2	.056	.7	.245	.2	.567	.7	1.024	.2	1.614	.7	2.337	.2	3.194	.7	4.185	36.0	7.07	53.5	15.61
.3	.059	.8	.252	.3	.579	.8	1.039	.3	1.632	.8	2.360	.3	3.221	.8	4.215	36.5	7.27	54.0	15.90
.4	.063	.9	.260	.4	.590	.9	1.054	.4	1.651	.9	2.382	.4	3.247	.9	4.246	37.0	7.47	54.5	16.20
3.5	.067	7.0	.267	10.5	.601	14.0	1.069	17.5	1.670	21.0	2.405	24.5	3.275	28.0	4.276	37.5	7.67	55.0	16.50
.6	.071	.1	.275	.6	.613	.1	1.084	.6	1.680	.1	2.428	.6	3.301	.1	4.307	38.0	7.88	55.5	16.80
.7	.075	.2	.283	.7	.624	.2	1.100	.7	1.709	.2	2.451	.7	3.328	.2	4.337	38.5	8.08	56.0	17.10
.8	.079	.3	.291	.8	.636	.3	1.115	.8	1.728	.3	2.474	.8	3.355	.3	4.368	39.0	8.30	56.5	17.41
.9	.083	.4	.299	.9	.648	.4	1.131	.9	1.748	.4	2.498	.9	3.382	.4	4.399	39.5	8.51	57.0	17.72
4.0	.087	7.5	.307	11.0	.660	14.5	1.147	18.0	1.767	21.5	2.521	25.0	3.409	28.5	4.430	40.0	8.73	57.5	18.03
.1	.092	.6	.315	.1	.672	.6	1.163	.1	1.787	.6	2.545	.1	3.436	.6	4.461	40.5	8.95	58.0	18.35
.2	.096	.7	.323	.2	.684	.7	1.179	.2	1.807	.7	2.568	.2	3.464	.7	4.493	41.0	9.17	58.5	18.67
.3	.101	.8	.332	.3	.696	.8	1.195	.3	1.827	.8	2.592	.3	3.491	.8	4.524	41.5	9.39	59.0	18.99
.4	.106	.9	.340	.4	.709	.9	1.211	.4	1.847	.9	2.616	.4	3.519	.9	4.555	42.0	9.62	59.5	19.31

BASAL AREA in square feet for each tenth of an inch diameter

Example. To obtain volume for an 8.0 inches diameter and 8 feet long:
8.0 x 0.349 = 2.792 (Round to 2.79 cubic feet)

ALBERTA CUBIC FOOT RULE

TABLE OF TEN TIMES VOLUMES OF CYLINDERS IN CUBIC FEET

(As Revised Feb./75)

Length of Log in Feet	2 in Diam.	3 in. Diam.	4 in. Diam.	5 in. Diam	6 in. Diam.	7 in. Diam.	8 in. Diam.	9 in. Diam.	10 in. Diam.	11 in. Diam.	12 in. Diam.	13 in. Diam.	14 in. Diam.	15 in. Diam.	16 in. Diam.	17 in. Diam.	18 in. Diam.	19 in. Diam.	20 in. Diam.	21 in Diam.	Length of Logs in Feet
1	0.2181	0.4908	0.8726	1.3635	1.9635	2.6725	3.4906	4.4178	5.4541	6.5995	7.8540	9.2175	10.6901	12.2718	13.9626	15.7625	17.6715	19.6895	21.8166	24.0528	1
2	0	1	2	3	4	5	7	9	11	11	16	18	21	25	28	32	35	39	44	48	2
3	1	1	3	4	6	8	10	13	16	20	24	28	32	37	42	47	53	59	65	72	3
4	1	2	3	5	8	11	14	18	22	26	31	37	43	49	56	63	71	79	87	96	4
5	1	2	4	7	10	13	17	22	27	33	39	46	53	61	70	79	88	98	109	120	5
6	1	3	5	8	12	16	21	26	33	40	47	55	64	74	84	96	106	118	131	144	6
7	2	3	6	10	14	19	24	31	38	46	55	65	75	86	98	110	124	138	153	168	7
8	2	4	7	11	16	21	28	35	44	53	63	74	85	98	112	126	141	157	174	192	8
9	2	4	8	12	18	24	31	40	49	59	71	83	96	110	126	142	159	177	196	216	9
10	2	5	9	14	20	27	35	44	54	66	78	92	107	123	140	158	177	197	218	240	10
11	2	5	10	15	22	29	38	49	60	73	86	101	118	135	154	173	194	217	240	265	11
12	3	6	10	16	24	32	42	53	65	79	94	111	128	147	167	189	212	236	262	289	12
13	3	6	11	18	26	35	45	57	71	86	102	120	139	160	181	205	230	256	284	313	13
14	3	7	12	19	27	37	49	62	76	92	110	129	150	172	195	221	247	276	305	337	14
15	3	7	13	20	29	40	52	66	82	99	118	138	160	184	209	236	265	295	327	361	15
16	3	8	14	22	31	43	56	71	87	106	126	147	171	196	223	252	283	315	349	385	16
17	4	8	15	23	33	45	59	75	93	112	133	157	182	209	237	268	300	335	371	409	17
18	4	9	16	24	35	48	63	79	98	119	141	166	192	221	251	284	318	354	393	433	18
19	4	9	17	26	37	51	66	84	104	125	149	175	203	233	265	299	336	374	415	457	19
20	4	10	17	27	39	53	70	88	109	132	157	184	214	245	279	315	353	394	436	481	20
21	5	10	18	29	41	56	73	93	115	139	165	194	224	258	293	331	371	413	458	505	21
22	5	11	19	30	43	59	77	97	120	145	173	203	235	270	307	347	389	433	480	529	22
23	5	11	20	31	45	61	80	101	125	152	181	212	246	282	321	363	406	453	502	553	23
24	5	12	21	33	47	64	84	106	131	158	188	221	257	294	335	378	424	472	524	577	24
25	5	12	22	34	49	67	87	110	136	165	196	230	267	307	349	394	442	492	545	601	25
26	6	13	23	35	51	69	91	115	142	172	204	240	278	319	363	410	459	512	567	625	26
27	6	13	24	37	53	72	94	119	147	178	212	249	289	331	377	426	477	532	589	649	27
28	6	14	24	38	55	75	98	124	153	185	220	258	299	344	391	441	495	551	611	673	28
29	6	14	25	40	57	78	101	128	158	191	228	267	310	356	405	457	512	571	633	697	29
30	6	15	26	41	59	80	105	132	164	198	236	276	321	368	419	473	530	591	654	722	30
31	7	15	27	42	61	83	108	137	169	205	243	286	331	380	433	489	548	610	676	746	31
32	7	16	28	44	63	85	112	141	174	211	251	295	342	393	447	504	565	630	698	770	32
33	7	16	29	45	65	88	115	146	180	218	259	304	352	405	461	520	583	650	720	794	33
34	7	17	30	46	67	91	119	150	185	224	267	313	363	417	475	536	601	669	742	818	34
35	8	17	31	48	69	94	122	155	191	231	275	323	374	430	489	552	618	689	764	842	35
36	8	18	31	49	71	96	126	159	196	238	283	332	385	442	503	567	636	709	785	866	36
37	8	18	32	50	73	99	129	163	202	244	291	341	396	454	517	583	654	728	807	890	37
38	8	19	33	52	75	102	133	168	207	251	298	350	406	466	531	599	671	748	829	914	38
39	8	19	34	53	77	104	136	172	213	257	306	360	417	479	545	615	689	768	851	938	39
40	9	20	35	54	78	107	140	177	218	264	314	369	428	491	558	630	707	788	873	962	40
41	9	20	36	56	81	110	143	181	224	271	322	378	438	503	572	646	725	807	894	986	41
42	9	21	37	57	82	112	147	185	229	277	330	387	449	515	586	662	742	827	916	1010	42
43	9	21	38	59	84	115	150	190	234	284	338	396	460	528	600	673	760	847	938	1034	43
44	10	22	38	60	86	118	154	194	240	290	346	406	470	540	614	693	777	866	960	1058	44
45	10	22	39	61	88	120	157	199	245	297	353	415	481	552	628	709	795	886	982	1082	45
46	10	23	40	63	90	123	161	203	251	304	361	424	492	564	642	725	813	906	1004	1106	46
47	10	23	41	64	92	126	164	207	256	310	369	433	502	577	656	741	831	925	1025	1130	47
48	10	24	42	65	94	128	167	212	262	317	377	442	513	589	670	757	848	945	1047	1154	48
49	11	24	43	67	96	131	171	216	267	323	385	452	524	601	684	772	866	965	1069	1179	49
50	11	24	44	68	98	134	174	221	273	330	393	461	534	614	698	788	884	984	1091	1203	50

ALBERTA CUBIC FOOT RULE

TABLE OF TEN TIMES VOLUMES OF CYLINDERS IN CUBIC FEET

(As Revised Feb./75)

Length of Log in Feet	22 in. Diam.	23 in. Diam.	24 in. Diam.	25 in. Diam.	26 in. Diam.	27 in. Diam.	28 in. Diam.	29 in. Diam.	30 in. Diam.	31 in. Diam.	32 in. Diam.	33 in. Diam.	34 in. Diam.	35 in. Diam.	36 in. Diam.	37 in. Diam.	38 in. Diam.	39 in. Diam.	40 in. Diam.	41 in.. Diam.	Length of logs in Feet
1	26.3981	28.8525	31.4160	34.0885	36.8701	39.7608	42.7608	45.8695	49.0875	52.4145	55.8506	59.3958	63.0501	66.8135	70.6860	74.6675	78.7581	82.9578	87.2666	91.6845	1
2	53	58	63	68	74	80	86	92	98	105	112	119	126	134	141	149	158	166	175	183	2
3	79	87	94	102	111	119	128	138	147	157	168	178	189	200	212	224	236	249	262	275	3
4	106	115	126	136	147	159	171	183	196	210	223	238	252	267	283	299	315	332	349	367	4
5	132	144	157	170	184	199	214	229	245	262	279	297	315	334	353	373	394	415	436	458	5
6	158	173	188	205	221	239	257	275	295	314	335	356	378	401	424	448	473	498	524	550	6
7	185	202	220	239	258	278	299	321	344	367	391	416	441	468	495	523	551	581	611	642	7
8	211	231	251	273	295	318	342	367	393	419	447	475	504	534	565	597	630	664	698	733	8
9	238	260	283	307	332	358	385	413	442	472	503	535	567	601	636	672	709	747	785	825	9
10	264	288	314	341	369	398	423	459	491	524	558	594	630	668	707	747	788	830	873	917	10
11	290	317	346	375	406	437	470	505	540	577	614	653	694	735	778	821	866	913	960	1009	11
12	317	346	377	409	442	477	513	550	589	629	670	713	757	802	848	896	945	995	1047	1100	12
13	343	375	408	443	479	517	556	596	638	681	726	772	820	868	919	971	1024	1078	1134	1192	13
14	370	404	440	477	516	557	599	642	687	734	782	831	883	935	990	1045	1103	1161	1222	1284	14
15	396	433	471	511	553	596	641	688	736	786	838	891	946	1002	1060	1120	1181	1244	1309	1375	15
16	422	462	503	545	590	636	684	734	785	839	894	950	1009	1069	1131	1195	1260	1327	1396	1467	16
17	449	490	534	579	627	676	727	780	834	891	949	1010	1072	1136	1202	1269	1339	1410	1484	1559	17
18	475	519	565	614	664	716	770	826	884	943	1005	1069	1135	1203	1272	1344	1418	1493	1571	1650	18
19	502	548	597	648	700	755	812	871	933	996	1061	1128	1198	1269	1343	1419	1496	1576	1658	1742	19
20	528	577	628	682	737	795	855	917	982	1048	1117	1188	1261	1336	1414	1493	1575	1659	1745	1834	20
21	554	606	660	716	774	835	898	963	1031	1101	1173	1247	1324	1403	1484	1568	1654	1742	1833	1925	21
22	581	635	691	750	811	875	941	1009	1080	1153	1229	1307	1387	1470	1555	1643	1733	1825	1920	2017	22
23	607	664	723	784	848	914	983	1055	1129	1205	1285	1366	1450	1537	1626	1717	1811	1908	2007	2109	23
24	633	692	754	818	885	954	1026	1101	1178	1258	1340	1425	1513	1603	1696	1792	1890	1991	2094	2200	24
25	660	721	785	852	922	994	1069	1147	1227	1310	1396	1485	1576	1670	1767	1867	1969	2074	2182	2292	25
26	686	750	817	886	959	1034	1112	1193	1276	1363	1452	1544	1639	1737	1838	1941	2048	2157	2269	2384	26
27	713	779	848	920	995	1073	1154	1238	1325	1415	1508	1604	1702	1804	1908	2016	2126	2240	2356	2475	27
28	739	808	880	954	1032	1113	1197	1284	1374	1468	1564	1663	1765	1871	1979	2091	2205	2323	2443	2567	28
29	765	837	911	989	1069	1153	1240	1330	1423	1520	1620	1722	1828	1938	2050	2165	2284	2406	2531	2659	29
30	792	866	942	1023	1106	1193	1283	1376	1473	1572	1675	1782	1891	2004	2121	2240	2363	2489	2618	2751	30
31	818	894	974	1057	1143	1233	1326	1422	1522	1625	1731	1841	1954	2071	2191	2315	2441	2572	2705	2842	31
32	845	923	1005	1091	1180	1272	1368	1468	1571	1677	1787	1901	2018	2138	2262	2389	2520	2655	2792	2934	32
33	871	952	1037	1125	1217	1312	1411	1514	1620	1730	1843	1960	2081	2205	2333	2464	2599	2738	2880	3026	33
34	897	981	1068	1159	1254	1352	1454	1560	1669	1782	1899	2019	2144	2272	2403	2539	2678	2821	2967	3117	34
35	924	1010	1100	1193	1290	1392	1497	1605	1718	1834	1955	2079	2207	2333	2474	2613	2757	2904	3054	3209	35
36	950	1039	1131	1227	1327	1431	1539	1651	1767	1887	2011	2138	2270	2405	2545	2688	2835	2986	3142	3301	36
37	977	1067	1162	1261	1364	1471	1582	1697	1816	1939	2066	2198	2333	2472	2615	2763	2914	3069	3229	3392	37
38	1003	1096	1194	1295	1401	1511	1625	1743	1865	1992	2122	2257	2396	2539	2686	2837	2993	3152	3316	3484	38
39	1029	1125	1225	1329	1438	1551	1668	1789	1914	2044	2178	2316	2459	2606	2757	2912	3072	3235	3403	3576	39
40	1056	1154	1257	1363	1475	1590	1710	1835	1963	2097	2234	2376	2522	2672	2827	2987	3150	3318	3491	3667	40
41	1082	1183	1288	1398	1512	1630	1753	1881	2013	2149	2290	2435	2585	2739	2898	3061	3229	3401	3578	3759	41
42	1109	1212	1319	1432	1549	1670	1796	1926	2062	2201	2346	2495	2648	2806	2969	3136	3308	3484	3665	3851	42
43	1135	1241	1351	1466	1585	1710	1839	1972	2111	2254	2402	2554	2711	2873	3039	3211	3387	3567	3752	3942	43
44	1161	1269	1382	1500	1622	1749	1881	2018	2160	2306	2457	2613	2774	2940	3110	3285	3465	3650	3840	4034	44
45	1188	1298	1414	1534	1659	1789	1924	2064	2209	2359	2513	2673	2837	3007	3181	3360	3544	3733	3927	4126	45
46	1214	1327	1445	1568	1696	1829	1967	2110	2258	2411	2569	2732	2900	3073	3251	3435	3623	3816	4014	4217	46
47	1241	1356	1477	1602	1733	1869	2010	2156	2307	2463	2625	2792	2963	3140	3322	3509	3702	3899	4102	4309	47
48	1267	1385	1508	1636	1770	1908	2052	2202	2356	2516	2681	2851	3026	3207	3393	3584	3780	3982	4189	4401	48
49	1294	1414	1539	1670	1807	1948	2095	2248	2406	2568	2737	2910	3089	3274	3464	3659	3859	4065	4276	4493	49
50	1320	1443	157	1704	1843	1988	2138	2293	2454	2621	2792	2970	3152	3341	3534	3733	3938	4143	4363	4584	50

(As revised Feb./75)

ALBERTA CUBIC FOOT RULE

TABLE OF TEN TIMES VOLUMES OF CYLINDERS IN CUBIC FEET

Length of Log in Feet	22 in. Diam.	23 in. Diam.	24 in. Diam.	25 in. Diam.	26 in. Diam.	27 in. Diam.	28 in. Diam.	29 in. Diam.	30 in. Diam.	31 in. Diam.	32 in. Diam.	33 in. Diam.	34 in. Diam.	35 in. Diam.	36 in. Diam.	37 in. Diam.	38 in. Diam.	39 in. Diam.	40 in. Diam.	41 in Diam.	Length of Log in Feet
51	1346	1471	1602	1733	1880	2028	2181	2339	2503	2673	2848	3029	3216	3407	3605	3808	4017	4231	4451	4676	51
52	1373	1500	1634	1773	1917	2068	2223	2385	2552	2725	2904	3089	3279	3474	3676	3883	4095	4314	4538	4768	52
53	1399	1529	1665	1807	1954	2107	2266	2431	2602	2778	2960	3148	3342	3541	3746	3957	4174	4397	4625	4859	53
54	1425	1558	1696	1841	1991	2147	2309	2477	2651	2830	3016	3207	3405	3608	3817	4032	4253	4480	4712	4951	54
55	1452	1587	1726	1875	2028	2187	2352	2523	2700	2883	3072	3267	3468	3675	3886	4107	4332	4563	4800	5043	55
56	1478	1616	1759	1909	2065	2227	2395	2569	2749	2935	3128	3326	3531	3741	3958	4181	4410	4646	4887	5134	56
57	1505	1645	1791	1943	2102	2266	2437	2614	2793	2983	3183	3386	3594	3803	4029	4256	4489	4729	4974	5226	57
58	1531	1673	1822	1977	2138	2306	2480	2660	2847	3040	3239	3445	3657	3875	4100	4331	4568	4812	5061	5318	58
59	1557	1702	1854	2011	2175	2346	2523	2706	2896	3092	3295	3504	3720	3942	4170	4405	4647	4894	5149	5409	59
60	1584	1731	1885	2045	2212	2386	2566	2752	2945	3145	3351	3564	3783	4009	4241	4480	4725	4977	5236	5501	60
61	1610	1760	1916	2079	2249	2425	2608	2798	2994	3197	3407	3623	3846	4076	4312	4555	4804	5060	5323	5593	61
62	1637	1789	1948	2113	2286	2465	2651	2844	3043	3250	3463	3682	3909	4142	4382	4629	4883	5143	5410	5684	62
63	1663	1817	1979	2148	2323	2505	2694	2890	3092	3302	3519	3742	3972	4209	4453	4704	4962	5226	5498	5776	63
64	1690	1846	2011	2182	2360	2545	2737	2936	3142	3354	3575	3801	4035	4276	4524	4779	5040	5309	5585	5868	64
65	1716	1875	2042	2216	2397	2584	2779	2981	3191	3407	3630	3861	4098	4343	4595	4853	5119	5392	5672	5959	65
66	1742	1903	2073	2250	2433	2624	2822	3027	3240	3459	3686	3920	4161	4410	4665	4928	5198	5475	5760	6051	66
67	1769	1931	2105	2284	2470	2664	2865	3073	3289	3512	3742	3980	4224	4476	4736	5003	5277	5558	5847	6143	67
68	1795	1960	2136	2318	2507	2704	2908	3119	3338	3564	3798	4039	4287	4543	4807	5077	5356	5641	5934	6234	68
69	1821	1988	2168	2352	2544	2745	2950	3165	3387	3617	3854	4098	4350	4610	4877	5152	5434	5723	6021	6326	69
70	1848	2016	2199	2386	2581	2783	2993	3211	3436	3669	3910	4158	4413	4677	4948	5227	5513	5807	6109	6418	70
71	1874	2044	2231	2420	2618	2823	3036	3257	3485	3721	3965	4217	4476	4744	5019	5301	5592	5890	6196	6510	71
72	1901	2072	2262	2454	2655	2863	3079	3303	3534	3774	4021	4276	4540	4811	5089	5376	5671	5974	6284	6601	72
73	1927	2099	2293	2488	2691	2903	3121	3348	3583	3826	4077	4336	4603	4877	5160	5451	5749	6057	6370	6693	73
74	1953	2127	2325	2522	2728	2942	3164	3394	3632	3879	4133	4395	4666	4944	5231	5525	5828	6139	6458	6785	74
75	1980	2154	2356	2557	2765	2982	3207	3440	3682	3931	4189	4455	4729	5011	5301	5600	5907	6222	6545	6876	75
76	2006	2183	2387	2591	2802	3022	3250	3486	3731	3983	4245	4514	4792	5078	5372	5675	5986	6305	6632	6968	76
77	2033	2211	2419	2625	2839	3062	3292	3532	3780	4036	4300	4574	4855	5145	5443	5749	6064	6388	6719	7060	77
78	2059	2240	2450	2659	2876	3101	3335	3578	3829	4088	4356	4633	4918	5211	5513	5824	6143	6471	6807	7151	78
79	2086	2268	2482	2693	2913	3141	3378	3624	3878	4141	4412	4692	4981	5278	5584	5899	6222	6554	6894	7243	79
80	2112	2297	2513	2727	2950	3181	3421	3670	3927	4193	4468	4752	5043	5345	5655	5973	6301	6637	6981	7335	80
81	2139	2325	2545	2761	2986	3221	3464	3715	3976	4246	4524	4811	5107	5412	5726	6048	6379	6720	7068	7426	81
82	2165	2354	2576	2795	3023	3260	3506	3761	4025	4298	4580	4870	5170	5479	5796	6123	6458	6802	7156	7518	82
83	2191	2382	2608	2829	3060	3300	3549	3807	4074	4350	4636	4930	5233	5545	5867	6197	6537	6886	7243	7610	83
84	2217	2411	2639	2863	3097	3340	3592	3853	4123	4403	4691	4989	5296	5612	5938	6272	6616	6968	7330	7701	84
85	2244	2439	2670	2897	3134	3380	3635	3899	4172	4455	4747	5049	5359	5679	6008	6347	6694	7051	7418	7793	85
86	2270	2468	2702	2932	3171	3419	3677	3945	4221	4508	4803	5108	5422	5746	6079	6421	6773	7134	7505	7885	86
87	2297	2496	2733	2966	3208	3459	3720	3991	4271	4560	4859	5167	5485	5813	6150	6496	6852	7217	7592	7976	87
88	2323	2525	2765	3000	3245	3499	3763	4036	4320	4613	4915	5227	5548	5880	6220	6571	6931	7300	7679	8068	88
89	2349	2553	2796	3034	3281	3539	3806	4082	4369	4665	4971	5286	5611	5946	6291	6645	7009	7383	7767	8160	89
90	2376	2582	2827	3068	3318	3578	3848	4128	4418	4717	5026	5346	5674	6013	6362	6720	7088	7466	7854	8252	90
91	2402	2611	2859	3102	3355	3618	3891	4174	4467	4770	5082	5405	5738	6080	6432	6795	7167	7549	7941	8343	91
92	2428	2639	2890	3136	3392	3658	3934	4220	4516	4822	5138	5464	5801	6147	6503	6869	7246	7632	8028	8435	92
93	2455	2668	2922	3170	3429	3698	3977	4266	4565	4875	5194	5524	5864	6214	6574	6944	7324	7715	8116	8527	93
94	2481	2696	2953	3204	3466	3737	4019	4312	4614	4927	5250	5583	5927	6280	6644	7019	7403	7798	8203	8618	94
95	2508	2725	2984	3238	3503	3777	4062	4358	4663	4979	5306	5643	5990	6347	6715	7093	7482	7881	8290	8710	95
96	2534	2754	3016	3272	3539	3817	4105	4403	4712	5032	5362	5702	6053	6414	6786	7168	7561	7964	8378	8802	96
97	2561	2782	3047	3306	3576	3857	4148	4449	4761	5084	5417	5761	6116	6481	6856	7243	7640	8047	8465	8893	97
98	2587	2810	3079	3341	3613	3897	4190	4495	4811	5137	5473	5821	6179	6548	6927	7317	7719	8130	8552	8985	98
99	2613	2839	3110	3375	3650	3936	4233	4541	4860	5189	5529	5880	6242	6614	6998	7392	7799	8213	8639	9077	99
100	2640	2868	3142	3409	3687	3976	4276	4587	4909	5241	5585	5940	6305	6681	7069	7467	7876	8296	8727	9168	100

GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF LANDS AND FORESTS

ALBERTA FOREST SERVICE

Timber Management Branch

FOREST MANAGEMENT

THE SALE OF TIMBER ON TREE SCALE IN ALBERTA

CHAPTER 26

April, 1963.

FOREST MANAGEMENT

CHAPTER 26

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FOREST MANAGEMENT

THE SALE OF TIMBER ON TREE SCALE IN ALBERTA

CHAPTER 26

A. Introduction:

Legislation authorized under The Forests Act 1961, the Forest Management Regulations and amendments thereto provides for adherence to the fundamental principle in the management of Alberta's forest resource of retention by the Crown of title to its forest land and the granting of timber rights thereon.

Cutting rights are granted at the present time by three forms: The major one is the Timber Licence generally applicable to the lumber industry, another is the Timber Permit designed for limited commercial and non-commercial users, and the third one is the Timber Lease primarily serving the pulp and plywood industries and Tree Farms. In dealing with the development of the tree scale system in Alberta up to the present time, this paper will pertain largely to the Timber Licence, to a minor degree to the Timber Permit and not at all to the Timber Lease.

Four basic methods of assessing timber dues by the Crown are available as listed below in the order from the finished product to the raw material; 1. Sales, 2. Manufacture, 3. Log Scale, 4. Tree Scale.

A brief review of some of the disadvantages of the first three methods above follows:

1. Sales -

By far the majority of timber operations in Alberta come under the sales category whereby Crown dues are based on the sale of the end product.

In recent years a number of problems inherent to the sales system are becoming increasingly complex and therefore are much more difficult and costly to administer. Numerous examples may be cited, such as

(a) the problem of accurately recording, confirming the source and in turn correctly paying the dues assessable against the product sold from one planer yard handling material delivered from one or more sawmills manufacturing timber from several to even as high as ten licensed areas with different rates of dues;

(b) the problem of achieving proper utilization at sawmills of various ownerships, designs, efficiencies and state of repairs;

(c) the problem of establishing and assessing dues on standard and odd lumber sizes;

(d) the problem of dockage; i.e., some dealers take an allowance from vendors to compensate for mis-manufacture, etc., the allowance varying considerably between dealers;
(e) the problem of properly recording and cross-checking all logging, sawing, planing, hauling shipping, exporting and other records for both Crown and company purposes.

Finally, under the sales system, the contract rate of dues applies equally to all lumber grades, high, medium and cull upon sale; consequently there is less incentive for increased utilization comparing this system to the log and tree scale systems.

The above should suffice to illustrate some predicaments faced in basing the dues system on the sale of the end product.

2. Manufacture -

Under the category of manufacture, dues are based on sawmill production or, in other words, on rough lumber. This system has been used only to a limited degree to date in Alberta whenever it was deemed advisable to assess dues at individual sawmills each manufacturing timber with different rates of dues and before the production was mixed at the planer yards. This state of dues assessment is similar to that used in the oil industry where royalties are based on wellhead production of crude oil rather than on the multitude of refined products designed for special uses. Oil well production controls are stringently maintained by the oil companies as ordered by the Oil and Gas Conservation Board but the timber industry of this Province recognizes that a similar point of dues assessment would be logical in application to unfinished forest products but would not be feasible in actual practise.

3. Log Scale -

The practise of log scaling in Alberta was re-established in 1955 with the adoption by order-in-council of the International 5/16" Log Rule. To date, a significant number of larger lumber companies have applied voluntarily to place their operations on log scale and received approval for this practise. Section 59 of the Forest Management Regulations now authorizes the Minister to change an operation to log scale, tree scale or sale, the main intent being to group operations under a common dues system.

To illustrate there is considerable scope for confusion in the recording of lumber volumes, cases have arisen in the last few years where some sawmills on log scale are for example actually sawing 7/4" stock; the contractor, trucker, etc., are paid on 6/4"; the material is sawn, planed, exported in the winter in a green condition and invoiced for sale as 2". In addition, the non-exportable balance may be sold locally itself often resulting in a 7% over-run. In sum total, actual and

paper over-runs may therefore range as high as 25% by manipulation of figures that defy vertification unless each stage is checked at the right time.

Log scaling costs are not standardized due to the fact they vary inversely with mill production as illustrated by the following hypothetical cases:

Scaler's Daily Wage	Daily Sawmill Production	Daily Scaling Cost
$10.00	10 M F.B.M.	$1.00/M F.B.M.
$10.00	25 M F.B.M.	$ .40/M F.B.M.
$10.00	40 M F.B.M.	$ .25/M F.B.M.

The foregoing also signifies that log scaling is not an economical practise on smaller operations which number in the majority in Alberta.

One of the cardinal points that may best be raised at this juncture is that whether dues are based on sales, manufacture, log scale or tree scale, someone has to pay the cost of measuring whether it be the Crown and/or the industry.

It is estimated that 90% of sawlog operations in Alberta use the tree length logging method better known as the "hot logging" practise, consequently it is impossible to conduct proper log scaling checks. Such checks are essential to the Crown in the implementation of the log scaling system.

To date, log scalers are paid by licensees but are required to scale under Government regulations; consequently some scalers are subjected to adverse pressure which has tended to influence the log scale upon occasion. The late Hon. Gordon Sloan in his 1945 (Page 166) and 1956 (Page 540) B.C. Royal Commission Forestry Reports stated in reference to log scaling in the interior of British Columbia by licensed and permit scalers that "to leave the computations of the amount owing the Crown in the control of the man who has to pay it, or his employees, does not seem to me to be an efficient system unless effective safeguards are provided to protect the Crown's financial interests."

The foregoing covers in general the major unsatisfactory situations concerning log scaling practises in Alberta.

4. Tree Scale -

In late 1959 after a detailed study of the difficulties in the general implementation in Alberta of the log scaling and sales systems,

the Alberta Forest Service initiated the development of a new system concerned primarily with the standing trees only, which we then named the "tree scale system". Interest in this system has since been shown by other provinces, particularly by Ontario.

Five prime objectives under the tree scale system follow: To improve management in the woods, to provide incentives for increased utilization, to standarize scaling (measuring) cost, to make check scaling practical, and to improve the method of dues assessment.

B. The Application of the Tree Scale System:

1. General Procedure -

The Alberta Forest Service since the mid 1950's has been gradually converting Alberta's forest economy over to the sustained yield basis of forest management but this endeavour is seriously handicapped by the larger portion of the forest industry being concerned with the production of a single product, lumber.

Accordingly, two basic cutting systems are now in common use in Alberta, namely, the clear cutting system and the partial cutting system briefly summed up below.

(a) Under the partial cutting system, primarily because of administrative limitations plus the single product forest economy (i.e., lumber), the most common partial cutting method to date has been the stump diameter limit. Since the early 1950's, partial cutting based on the tree marking system has gradually increased, particularly in the Slave Lake Forest Division. The aim under the tree marking system is to remove close to 40% of the total volume in the first cut, and at the same time attain stand improvement and retain a regular forest canopy to minimize exposure to adverse effects such as windthrow. In a partial cut tree scale sale, individual trees selected for harvesting are marked and scaled. This new system will accomplish a major forest management objective by significantly reducing the number of stump diameter timber sales.

(b) In the case of a clear cut, the present procedure is to cruise the timber in our standard manner to about a 1 to 2% cruise intensity. If upon examination of the cruise report and other information the timber appears to be best offered for sale on a clear cut tree scale basis, a second cruise is conducted to an intensity of 10% or more which together with the cut layout plan determines the final volume on which dues are payable. This is done either prior to offering the timber for sale or progressively after the sale award by legal subdivisions (40 acre blocks) or on occasion even by timber types.

The cruise intensity may range even up to 50% depending primarily on the similarity of the merchantable types and the size of the total area in question. Therefore as rough generalities:

Larger homogeneous areas are sampled comparatively lightly and such smaller areas slightly more; larger heterogeneous areas are sampled fairly intensively and smaller heterogeneous areas require highly intensive sampling.

The optimum size of a tree scaling crew for partial or clear cuts is deemed to be 3 men, with a Forest Officer II acting as a foreman and 1 assistant working on either side.

2. Initial Tree Scale Problems -

There are several problems discussed below which have to be resolved in the development of the tree scale system to achieve its ultimate aims:

(a) Availability of Qualified Tree Scalers

It is estimated that probably 400 qualified log scalers would be required in this Province in a normal operating year if all operations were on log scale but it is expected that a much lesser number of qualified tree scalers would be required; a major reason being they can work the year round in advance of actual logging operations whereas log scalers are of necessity stationed at each mill during sawing operations.

To be assured of consistently reliable tree scale results, the first requisite of the Crown is the very careful selection and then the training of suitable field personnel for specialization in the tree scaling techniques.

From the personnel standpoint, the rudiments of log scaling can be taught and absorbed quite readily by new men but tree scaling is in sharp contrast being much more complex. Years of dedicated experience based on competent training and supplemented by supervised checks are essentials to the maintenance of a qualified tree scaler staff. As there are only a comparatively limited number of persons truly interested in woods work, keeping career tree scalers in Government service will probably be difficult and a high turnover can only be minimized by offering continuity of employment plus a fairly high pay schedule.

The tree scaler in practise carries a significant responsibility and in the performance of his duties, he must give due regard to both the technical forestry and economic aspects under all types of timber operating conditions; accordingly Crown dues and also to a large degree the conduct of forest operations depend upon his fair judgement.

The office compiler is also an important cog in the tree scale system and the volume compilations on an area sequence also require a continuing accuracy in mapping.

(b) Tree Scaling Costs

Reliable cost saving methods areas urgently needed in the routine phases of timber administration as in all other phases of timber operations. Tree scaling all trees designated for cutting on a partial cut sale area with 40% removal or sample tree scaling from 10% to say 20% on a strip or patch clear cut sale area with 100% removal is a means of saving time and money without any great sacrifice in volume accuracy. Sampling is recognized as a reliable shortcut in many aspects of forest management and as sampling techniques are developed and accepted, confidence in the results increases to the point of established practise.

In the implementation of the tree scale system, additional funds will be required which based on costs available to date in this Province averages about 50¢ per M F.B.M. . Obviously the more difficult and costly phase is to convert an operating licensed area over to the tree scale system in comparison with a new tree scale area being set up for sale. Nevertheless the estimated tree scale cost should significantly reduce the various logging, sawmilling, hauling, planing, exporting and other records presently required by the Crown under the sales system and in addition many further benefits should accrue to licensees in the planning, operating and sales phases.

Tree scale is naturally more attractive at first to the Crown than to the tree buyer as the Crown is responsible for the tree scaling task and is interested in economy, performance and fair results. As the Crown handles many timber sales, any possible errors would tend to be compensating; for the individual buyer, however, who does not have the advantage of holding a number of timber licences, he may adjust his bidding at the time of sale accordingly. It is axiomatic that the timber appraisal system could well be used in conjunction with the tree scale system in order to set a comparatively fair and sound upset rate of dues for each sale.

(c) Tree Scale Accuracy

It is quite difficult to determine accurately the volume of trees individually and collectively due to the eccentricities of diameter, the variations in form class and the differences in height. The advent of the tree scale system necessitates accurate tree scale estimates, consequently between the years of 1960 and 1962, the Alberta Forest Service obtained sufficient tree measurements based on samples from over 30 timber operations in various parts of the Province to be used in the preparation of a new set of form class volume tables based on the International 5/16"

Log Rule. These new tables have proven to be a considerable improvement over the standard volume tables hereto available.

Determination of the cull factor is another important aspect. Cull study results developed over the past five years or so in cooperation with the Federal Entomology and Pathology Laboratory are being introduced as they become available and have already proven to be a much improved method of assesssing tree cull.

Knowledge in the application of the cull factor can only be acquired through experience and careful and periodic study of individual logging operations. Hidden defects and the lack of external disease indicators are general characterisitics of coniferous timber growing in Alberta. To establish the cull factor, one procedure is to fell sample trees and scale the logs. The difference between the gross scale and net scale determines the factor, however, periodic checks at the sawmills are a requisite under this method.

The advent of the tree scale system places a renewed emphasis on improving all aspects of timber cruising techniques. Special studies are underway including cooperative studies with the Department of Forestry Forest Research Branch to increase tree scale accuracy by testing and improving on the various techniques.

An essential phase of the tree scale procedure is frequent check scaling. A certain percentage of trees must be check scaled by scaling the logs after the trees have been felled and bucked in order to adjust whenever necessary the volumes determined by the tree scale process. A ratio of log scale to tree scale for the same trees determines the correction factor to the total tree scale for the given period of operations. Possible errors due to measurement, defect, volume tables, etc., may then be adjusted for periodically by means of each check scale. In the initial stages of development of tree scale in Alberta, a safety factor of 5% has purposely been incorporated into the tree scale system, thereby giving the licensees the benefit of any doubts.

C. Tree Scale Advantages and Disadvantages:

Numerous pros and cons relative to the tree scale system may be cited, including the following:

1. Advantages -

(a) The ultimate aim is to mark and scale trees in advance of offering a licensed area for sale, consequently an interested bidder will have a much better opportunity to assess the timber chance before the sale date than under the present sale procedure.

(b) Timber can be marked and scaled at the same time and will eliminate the conventional procedure of cruising proposed sale areas. This will also fit in well with the orderly development of forested areas under the management plans gradually coming into use in Alberta.

(c) Improved utilization is obtainable. The tree scale system provides a much needed incentive which will reward the better operators with profits and the poorer ones find themselves in economic difficulties.

(d) The necessity of check scales requires frequent inspections by forest officers resulting in better supervision of operations. Under tree scale, the forest officer will be able to devote much more time to the woods phase rather than divide his time amongst all phases as required under the present system.

(e) Tree scale eliminates many problems and reduces cost associated with the sales and log scaling systems both for the Crown and the timber industry. Annual operating plan submissions will probably become a requisite for all future operations under tree scale.

2. Disadvantages -

(a) Particularly until tree scale becomes well established, tree scale may be questioned often by both operators and Crown employees. Inaccuracies will occur if frequent and proper check scales against the volume tables, cull, etc., are lacking. Although the final outcome of an operation also depends on the logging and milling crews and their equipment, the plan of operations and many other factors, the tree scaler may be given all the blame nevertheless.

(b) As trees are seldom cut in the same sequence as the tree scale field progress or office compilation, it may be difficult to obtain current checks on the amount cut until operations are completed and records audited. An exception would be a clear cut operation in alternate strips or patches with available corresponding tree volumes or in a partial cut with the timber extraction completed on the 40 acre grid or other pattern coinciding with the tree scaling procedure.

(c) If timber cruise requests, timber sales and tree scaling are not well planned and carried out in advance of need, cutting may be held up. This could be overcome with sufficient trained staff and facilities.

(d) Trees not scaled but cut during the course of road and millsite clearings and logging damage purposely or otherwise caused to reserve trees will not be paid for unless detected and measured during inspections. This can be minimized with the enforcement of annual operating plans.

D. Brief Review of Tree Scale Sales 1960-63:

Since the decision was made in 1960 to proceed with the tree scale system on a trial basis at first, 33 timber licences and 2 special timber permits have been granted under tree scale. The tenative estimates range from as low as 61 M F.B.M. to as high as 45,625 M F.B.M. on individual sale areas with a grand total as of January 1963 approximating 185 million feet. These sale areas have been located in 6 of the 9 Forest Divisions of the Alberta Forest Service to date. Of the 35 sales, only 3 have had complete estimates prepared prior to sale and the balance are being tree scaled in stages in advance of felling operations. Consequently, only a few tree scale sales have been completed but the results are promising as illustrated by the following examples:

Tree Scale Vol.	Audited Actual Production	Over or Under-Run
144,644 F.B.M.	162,145 F.B.M.	+ 11%
336,209 F.B.M.	351,972 F.B.M.	+ 5%
1,132,882 F.B.M.	1,107,500 F.B.M.	- 2%
1,681,995 F.B.M.	1,691,724 F.B.M.	+ 1%

When an underrun or overrun occurs, it is not logical to place all the blame on the tree scaler when the faller, skidder, bucker, sawyer, planer man, bookkeeper, foreman, etc., all have a part to play in the final production and consequent profit or loss.

It is expected that overruns under tree scale may attain an overall average of 10 to 15% providing all phases of operation are efficient and trained permanent tree scaling crews are used.

E. Conclusion:

In closing, the five major objectives attainable under the tree scale system follow:

1. To improve woods management,
2. To provide incentive for increased utilization,
3. To standardize scaling (measuring) costs,
4. To make check scaling practical,
5. To improve the method of dues assessment.

As Crown and industrial personnel become better acquainted with the application of the tree scale system, sale of timber on tree scale will increase in favour and in use.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

Timber Management Branch

ALBERTA FOREST SERVICE

TIMBER MANAGEMENT

CONIFEROUS TIMBER QUOTA RECONNAISSANCE CRUISE INSTRUCTIONS

CHAPTER 27

Revised December, 1972

TIMBER MANAGEMENT

CHAPTER 27

TIMBER MANAGEMENT CONIFEROUS TIMBER QUOTA

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CHAPTER 27

TIMBER MANAGEMENT

CONIFEROUS TIMBER QUOTA RECONNAISSANCE CRUISE INSTRUCTIONS

PART I GENERAL INSTRUCTIONS, OFFICE & FIELD PROCEDURES

27.1 Introduction

The Coniferous Timber Quota Reconnaissance Cruise is a system of forest inventory applied to a Management Unit to determine the timber condition, age, size, location and volume information necessary to develop a Coniferous Timber Quota Management Plan for the Unit. It is thus a distinctly different system from Detailed Timber Cruising.

27.10 Objectives & Purpose of Quota Reconnaissance Cruising

A pre-requisite to the Quota Reconnaissance Cruise procedure is a sound understanding of the cruise objectives. Cruising plays a key and a very important role in Management Planning. The cruiser makes measurements and observations related to age, volume, growth, condition, etc. and a Management Plan is prepared based on the accuracy of these measurements.

Fewer but reliable accurate and well distributed plots are much preferred over many plots of dubious accuracy. This is one of the major aims of these cruising instructions.

The primary purpose of a Quota Reconnaissance Cruise is to prepare a Management Plan which programs a systematic and orderly cutting progression over a rotation period and also calculates an age class distribution and an allowable cut for the area.

27.2 Quota Reconnaissance Crew and Responsibility

The Quota Reconnaissance Crew will consist of one person classified as a cruiser or in a two man crew the second man will be classified as a compassman. The cruiser will supervise and direct the compassman and will be responsible for the recording and accuracy of measurements obtained by his crew.

27.2.0 Cruiser

The requirements for a Cruiser who is to undertake Quota Reconnaissance Cruising are as follows:

1. Complete reliability and conscientious approach to his job.
2. Ability to interpret aerial photographs and recognize precisely his ground position on aerial photographs.
3. Ability to read and understand forest cover type maps.
4. Experience in operational or "sale" cruising, with ability to estimate:
   - (a) average volume per acre
   - (b) stand utilization classes (sawtimber, pulp and round timber or unmerchantable timber)
   - (c) stand condition class
   - (d) stand operability class
5. Ability to locate himself in the woods and make short solo traverses.

27.2.1 Compassman

The requirements of a Compassman on a Quota Reconnaissance Crew are:

1. Ability to read a compass and to follow a compass bearing in the bush.
2. Ability to read and understand forest cover type maps.

3. Ability to estimate (by pacing or other methods) distances travelled in the bush.
4. Reliability on long and irregular cross-country traverses.
5. Ability to accurately and neatly record field tally information.

27.2.2 Assistant Party Chief

Where several Cruisers are working out of one centralized camp, one will be designated as Assistant Party Chief. It is the responsibility of the Assistant Party Chief to:

Plan and delegate the daily work, supervise and co-ordinate the recording of the field results onto "master-maps" for the area, and maintain a liaison with the Party Chief insofar as camp movements and camp supply problems are concerned.

It is also the responsibility of the Assistant Party Chief to make a check on the reliability of the field measurements. This can best be covered by regular check cruising during the main cruise and frequently advising the cruiser of the results therefore achieving greater reliability. This is very important.

Uniformity in cruising can also be accomplished by rotating crew men.

27.2.3 Party Chief

Normally a Forest Management Technician, Forest Officer or other permanent management wage employee in each Forest will serve as the Party Chief for one or more crews working in the Forest under the direction of the Forester.

One of his functions is regular check cruising.

27.2.4 Office Preparation

As much of the work as possible should be completed in the office before going out to the field; this allows more time on the job and ensures accuracy. It is particularly important when large areas are being examined that the maps and photographs be given careful preparatory study. Each type area which can be reliably deleted from the field program on the basis of the aerial photographs or previously collected information should be so deleted.

This will include all:

(1) previous detailed cruise information either as licences or rejected cruised areas.
(2) forest surveys inventory plot data.
(3) land reservations or proposed reservations.
(4) uneconomical, inoperable types, watershed limitations, inaccessible types, etc. should also be eliminated from the field program.
(5) the Quota Reconnaissance maps should also be updated for any known fires prior to commencement of the field work.

Before commencement of field work all procedures should be established and reviewed with personnel involved to maintain the provincial standards.

The final work map should be drawn up for each Crew indicating the types requiring field examination by the Crew. Each Crew should also be supplied with aerial photographs covering their work area.

Once access, transportation and camp location problems have been solved, individual traverse layouts should be done by each Cruiser for the work areas allocated to him by his Party Chief. Each traverse and proposed sample point should be laid out on the Cruiser's field map and on the aerial photographs to take the cruiser into a representative part of the cover type to be examined.

After information at hand has been recorded and types for which information is adequate have been deleted from the field schedule, all type areas of height classes 3 and 4 (60 feet and up) except pure hardwood types must be checked and reported upon. Some two height class map types (2y 46' - 60') in each area should be checked in the field for advancement into 3 height class, and if advancement is common in that area, 2y height class map types should also be included in the Reconnaissance Program.

Quota Reconnaissance Cruising, if possible, should be scheduled during the spring, summer or fall. This is especially significant in the northern Forests where temperature and short days are a limiting factor and use of helicopters are required due to limited access. Also "Air Calls" should be minimized as there is a strong tendency to over-estimate.

27.2.5 Equipment Requirements

The following equipment should be made available to each "Crew":

1. Prisms BAF 10 or 20.
2. Diameter tape or tree calipers.
3. Hypsometer, abney level, or clinometer.
4. Type map.
5. Aerial photographs.
6. Protractor.
7. Engineers scale 6".
8. Pencils (lead and grease).
9. Photoholder.
10. Pocket stereoscope.
11. Compass.
12. Cruiser's vest.
13. Increment borer, 16".
14. Tally Book and sheets (Form CS-TM05 FBM or Form CS-TM08 Cubic Feet)
15. Flagging or boy's axe.
16. Two chain trailer tape.
17. Chain menders.

27.2.6 Type Maps

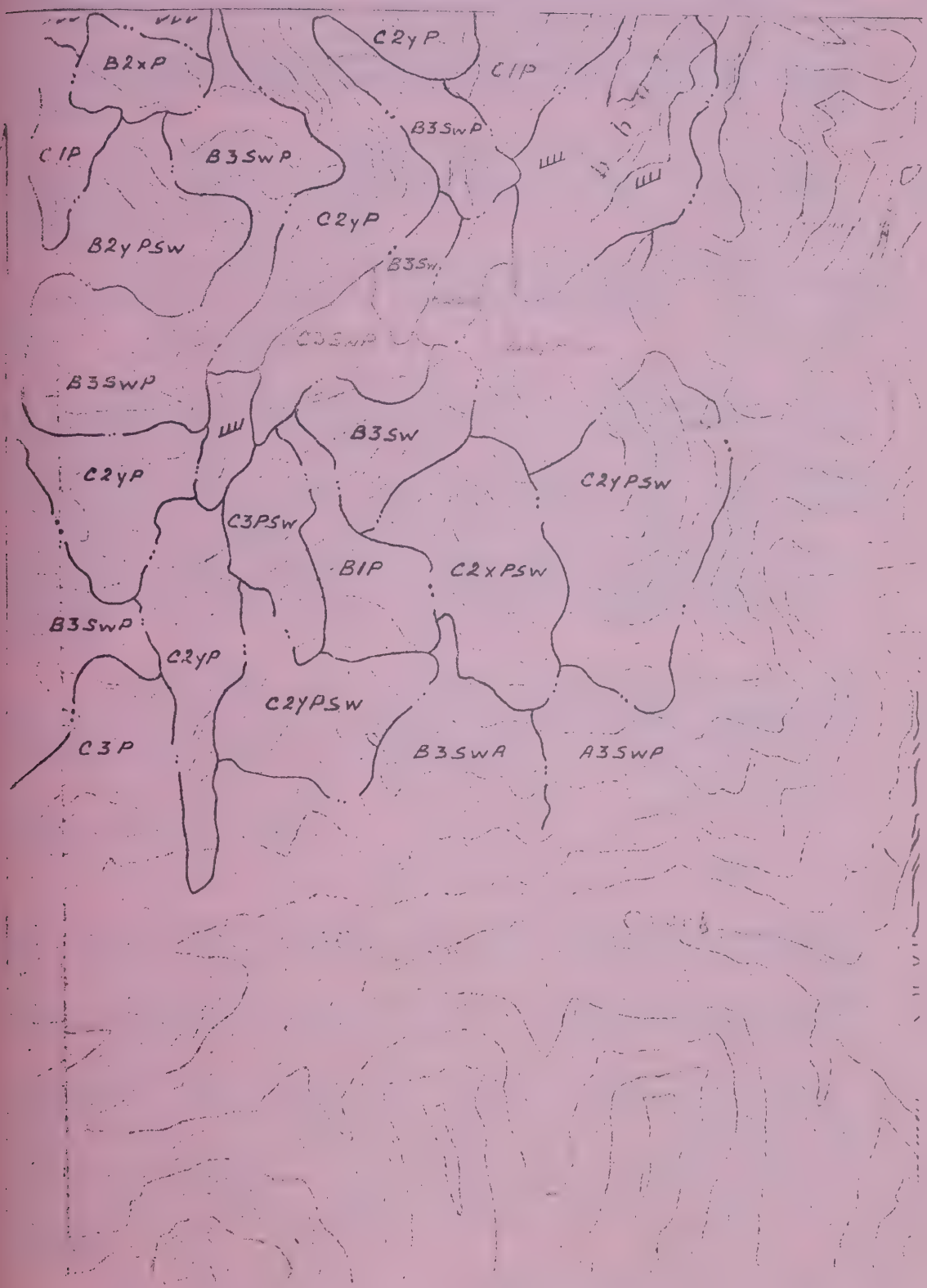
Quota Reconnaissance Cruising will be based in almost all instances on Quota Reconnaissance typing at a map scale of 2" to 1 mile (2640 feet to one inch). Minimum typing stand is to a forty acre minimum type size (40 acre standard established in 1970).

A new type of Quota Reconnaissance map, first for the Foothills Region, is being resolved in 1972-73 with the Technical Division. The new map will contain basically the same information as the previous map (except for changes in height class and density criteria) but will also show contours of 100 foot intervals. The contour lines appear slightly faded to distinguish them from type lines, creeks, etc. (See sample attached).

Types will be numbered in sequence by township and range and acreage figures will be made available for each type by Head Office prior to compilation.

NOTE: Type boundaries are not to be modified in the field. The field type should be changed from the map type description only after careful study of the aerial photograph in combination with the field check.

QUOTA RECONNAISSANCE TYPE MAP 1972-73 SAMPLE - FOOTHILLS REGION



Note: - These 100' contour intervals serve as background information and will substantially improve the operability classification which is a very important factor in all upper drainage basins.

Note: - re Photo Interpretation for Quota Reconnaissance Typing -

Each Forest can contribute significally the increased quality in photo-interpretation by submitting any recent (within 5 years) information on tree heights, species for a specific area.

This information can come from Quota Reconnaissance cruises, detailed cruises or other sources as long as it is accurate and fairly recent.

To submit the information show individual plot locations on a type map. At each plot note the species and average height of the trees in the plot using dominant and co-dominant trees. Note the date measurements were taken.

Any information of this nature will certainly aid photo-interpretation especially with the new 20 foot height classes.

27.2.7 Traverse Layout

The locations of the plots as they are intended to be placed in the field should be marked on the field map after close study of the aerial photographs to provide a route. All plots should be tied to a known control point by use of a compass and chain. The cruisers position in relation to these control points will provide a check on the accuracy of his location. As the cruiser walks through the type area to be cruised from his starting point to his tie point he should make mental note of the stand in general and possible general information can be placed in the Remarks portion of the Quota Reconnaissance Tally Sheet (Form No. CS-TM05 for FBM Quotas or Form No. CS-TM08 for Cubic Foot Quotas).

Cruise traverses should be run so as to cross drainage ridges and not along the contour of a side hill. A better cross section of the stand is realized from the lines that go up and down the slopes rather than along ridge tops or stream bottoms.

Determine the position of your traverse on your field map before going to the field.

Reliable representation of the entire type is the objective.

The traverse should be established in the field as accurately as is possible using a compass and the photographs as navigational aids.

Each arm of the traverse should be lettered with corresponding bearing and chainage on a single page for easy reference in the bush.

Once this is done, the Crew will travel precisely from the start point on the required bearing until the turning point marking the end of that arm of the traverse is reached. In areas of continuous timber where type boundaries are indefinite and tie points infrequent it may be necessary to pace check or even chain distances to accurately establish turning points. In most instances, however, turning points can be established by use of the aerial photographs, provided the crew is "on bearing".

The first essential of a successful Quota Reconnaissance is continuous and accurate Crew orientation on maps and photos.

If at any time the location of the Crew becomes indefinite, then all appraisal should stop until the cruiser locates himself on the photograph and map and places himself back on traverse.

The traverse should terminate at a definite tie or start point, so that the Crew is able to determine whether or not their traverse has been successfully established. In cases where the field traverse has deviated from that established on the map the line on the map and photos should be adjusted to correspond with the route followed in the field. If this adjustment indicates that types were missed, or that notes do not relate to the proper areas, a further traverse of the area will be necessary.

27.3 Field Work

27.3.0 Procedure to Sample Plot

As the Crew proceeds along the traverse, the Cruiser should make continuous observations and relate them to the map type and aerial photographs.

At a previously selected (from photos) point on the traverse, the Crew will stop and establish a sample point. If the timber at the sample point is not typical of the area as a whole, the Crew should progress along the traverse line until a representative part of the type area is reached.

An average number of merchantable "in" trees can be determined as the Cruiser proceeds along the traverse through the type. This is accomplished by stopping periodically and counting only the number of merchantable "in" trees with the use of the prism. If several periodic stops are made and the number of merchantable "in" trees recorded, an average is easy to determine and very little time is wasted.

For example: Type Number 286 -

1st stop counted 8 merchantable "in" trees
2nd stop counted 6 merchantable "in" trees
3rd stop counted 7 merchantable "in" trees
4th stop counted 10 merchantable "in" trees
5th stop counted 5 merchantable "in" trees
6th stop counted 4 merchantable "in" trees

Total 40

Average = 40 ÷ 6 = 6.6 merchantable "In" trees.

This average can be used at plot centre when a merchantable gross volume/acre is estimated. Suppose a prism point sample results in an estimated volume of 12,000 F.B.M. per acre (10" stump diameter class and up or 8.7" DBH and up) from a total of 8 trees. It then follows that a true average merchantable gross volume/acre should apply to the average number of merchantable "in" trees being 6.6. A true average merchantable gross volume/acre could be calculated as follows:-

$$\frac{6.6}{x} = \frac{8}{12{,}000}$$

$$8x = 79{,}200$$

$$x = 9{,}900$$

This indicated that the type has an average of 6.6 merchantable "in" trees per acre with a volume of 9,900 F.B.M. per acre. It also shows that plot centre estimated volume of 12,000 F.B.M. per acre could be a little high.

The same procedure is followed when using Tally Sheet Form No. CS-TM08 for cubic foot volumes.

Thus the actual plot will include both merchantable and unmerchantable (under 2 log trees and less than 8.7" D.B.H.) to determine the merchantable and also the total volume per acre.

27.3.1 Prism Plot Centre (Volume Sample)

In order to have some guide in estimating volume per acre, at least one prism plot should be established in each type area in a representative part of the type. Only one Tally Sheet Form CS-TM05 (for FBM Quotas) or one Tally Sheet Form CS-TM08 (for Cubic Foot Quotas) should be completed for one prism plot for one type.

At the prism point, two volumes should be established; Total Gross Volume Per Acre and Merchantable Gross Volume Per Acre

1. Total Gross Volume Per Acre:

This figure is the sum total of all the volume calculated from the back of the Tally Sheet Form No. CS-TM05 or CS-TM08; this includes both merchantable and unmerchantable volumes; thus - Total Gross Volume

2. Merchantable Gross Volume Per Acre:

This figure is the total volume on the back of the Tally Sheet which is considered merchantable.

The specifications for merchantable volume may vary as per each Forest Management Unit utilization standard.

Some basic merchantability specifications are noted below under "Quota Utilization Standards."

27.3.10 Quota Utilization Standards for Merchantability

1. F.B.M. Quota - Form No. CS-TM05 (mainly used in Boreal Region)

A merchantable volume per acre should include those trees which contain two or more sixteen foot logs to a 6.0" top on the basis of 10.0" S.D. class and up (8.7" D.B.H. which is 8.0" D.B.H. class) in the case of a sawlog quota.

In other words, to be classed as merchantable volume, the tree must be in the 8.0" D.B.H. class or greater and contain at least two 16 foot logs to a 6.0" top.

2. Cubic Foot Quota - Form No. CS-TM08 (for use mainly in the Foothills Region)

(a) To be classed as merchantable in a primarily round timber operation a tree must be:

- in 4.0" D.B.H. class or larger and contain at least one 6 foot bolt to a 3.0" D.I.B. top.

Example - calculating Total Gross Volume/Acre and Merchantable Gross Volume/acre for a primarily round timber operation:

1. If the cruise was intended for a round timber operation it would be cruised to the lowest D.B.H. class (4" D.B.H. using November 1972 revised CS-TM08).

2. In this case trees in the 4.0" D.B.H. class and larger would be tallied and would be classed as Merchantable.

3. Therefore, the Total Gross Volume/ acre and the Merchantable Gross Volume/ acre would be the same; i.e. they would be equal to the cumulative tally from the back of the tally sheet.

(b) To be classed as merchantable in a primarily pulpwood operation a tree must be:

- in the 5.0" D.B.H. class or larger in an area containing at least 8 cords/acre coniferous timber.

Example - calculating Total Gross Volume/acre and Merchantable Gross Volume/acre for primarily pulpwood operation.

1. Form No. CS-TM08 revised November, 1972 has lower diameter class of 4.0" D.B.H.

2. However, the lower merchantability limit for pulpwood is 5.0" D.B.H.

3. Therefore, the Total Gross Volume/acre would be the sum total of all volume on the tally sheet down to and including the lowest D.B.H. class (4.0" D.B.H.- based on November 1972 tally sheet revision)

4. Merchantable Gross Volume/acre would be the Total Gross Volume/acre minus the volume in the D.B.H. class under 5.0" or that volume in the 5.0" D.B.H. class and larger.

(c) To be classed as merchantable in a sawlog operation a tree must be

- in the 9.0" D.B.H. class or larger and at least 60 feet in height

Example - calculating Total Gross Volume/acre and Merchantable Gross Volume/acre for a sawlog operation:

1. the lower merchantability limit for sawlogs (when using Form No. CS-TM08) is 9.0" D.B.H. class and 60 foot height.

2. Therefore, Total Gross Volume/acre would be the sum total of all volume on the tally sheet down to the lowest D.B.H. class tallied.

3. Merchantable Gross Volume/acre would be that volume in the 9.0" D.B.H. class and larger in trees that are at least 60 feet in height.

NOTE: These utilization standards are all subject to modification per Forest and in tune with any current utilization improvements.

These volumes are determined with Volume Tally Table on the reverse side of the Tally Sheet.

NOTE: A 10" stump diameter measured 12" above average ground level is equal to an 8.7" D.B.H.

As the "in" trees are being tallied, they should be recorded on the cumulative volume tally using a vertical line (|) for spruce and a circle (◯) for pine.

Upon completion of the prism sample, the total volume per acre and the merchantable volume per acre (gross - with no cull allowance) should be recorded on the bottom line of the reverse side of the Form No. CS-TM 05 or CS-TM08. Spruce (fir) and pine volume should be combined but tallied as vertical line for spruce and ○ for pine. The traverse should then be continued to the point where it leaves the type area, with the cruiser comparing stand volume in the type as a whole to that on the prism point.

NOTE: There are three species of Spruce, White Spruce Sw; Black Spruce Sb; and Engelman Spruce Se. These should be recorded as White Spruce SW. Balsam Fir should also be recorded as White Spruce. (Capital letters required for D.P.C. keypunching.)

All of the Pines Pj, Pl, Pf should be recorded as Lodgepole Pine PL.

Aspen and Poplar should be designated Aw.

27.3.2 Completing the Quota Reconnaissance Tally Sheet

Note: Only 1 Tally Sheet Form No. CS-TM05 or CS-TM08 to be completed per type.

A Tally Sheet should be completed at a representative prism plot centre for each Forest Cover Type as described above. Basically the Tally Sheet is a check or a fill in the Box.

Each Box is numbered for computer programming.

Form No. TM05 has on the reverse side the Cumulative Volume Tally in F.B.M. Form No. TM08 contains the Cumulative Volume Tally in Cubic Feet and will be used primarily in the Crowsnest, Bow River, Rocky-Clearwater and Edson Forests.

The information on the front of both Tally Sheets is basically the same.

Some of the headings are explained as follows:-

1. Date, Cruiser and Compassman

   The date and name of each person should be written in this space.

2. Management Unit

   The Management Unit in which the type is located should be entered in this space. If it is a Management Unit such as A1 then it should be entered as | A | | 1 | (use far right block for 1 digit units)

3. Section, Township, Range and Meridian

   The section, township, range and meridian where the prism plot centre is located should be entered as follows Section 3 Township 85 Range 6 West 4th Meridian | | 3 | | 8 | 5 | | 6 | 4 |

4. Map Type

   The map type is entered in this space as shown on the field map and as described below.

5. Field Type

   The actual forest type which best describes the type should be recorded in this space. Enough spaces are provided to record stand density, height and a maximum

Care must be taken in completing the field type because of the necessity of providing 2 spaces for 2x & 2y height code.

Since the second and third spaces are assigned to stand height it must be remembered to leave the third space blank when assigning 3 and 4 height classification, or new reinventory classes 0 to 5.

Capital letters should also be used for D.P.C. keypunching.

For example:

A	2	X	S	W	P	L	A	W

A	3		S	W	P	L	A	W

NOTE: When the field type is different than the type it is very important when assigning the new field to use the same standards as was used when assigning the map type. This cannot be over emphasized. Also, remember that the map types were designated by experienced aerial interpreters and that the types are shown by crown density classes. Crown densities tend to look different when you are actually looking up through them than when you are viewing them from above from aerial photos. Field types should only be changed after close examination of the aerial photographs based to the 40 acre minimum, etc. Quota Reconnaissance standards and after studying the plot tally volume.

The plot tally volume will determine the predominant species. For example if there is more merchantable volume of spruce than of pine the field type should be written with spruce as the predominant species and pine as the secondary species. e.g. C3SWPL.

6. Type Number

This space is completed for entering the appropriate number for the type from the field map.

7. Plot Number - on Form No. CS-TM 08

Plot number to be entered if this Form is to be used for detailed cruising. e.g. S.T.P. and licences.

8. Type Area

This description should be checked and determined only after careful examination of the aerial photographs. The use of aerial photographs is very important in assessing this description correctly.

(a) Uniform - A relatively uniform or even stand, openings in the stand generally small, (under five acres) overstory primarily confined to one height class, species composition similar over the entire type area, with the same species predominant throughout all portions of the stand, though not necessarily to the same degree. Considerable variation in the diameters of trees, even in the overstory trees, is permissible.

(b) Variable - The entire type or stand area is generally occupied by merchantable forest except for occasional small (under five acres) openings or clearings. Considerable variation in height class and/or species composition exists, in addition to to variation in diameter class.

(c) Conglomerate - The type or stand area consists of groups or patches of merchantable coniferous timber interspersed in a generally unmerchantable environment. An example would be scattered 10 acre patches of 4 height spruce in pure aspen surroundings. If a type is conglomerate NOTES MUST BE MADE UNDER TYPE % CONGLOMERATE OF MERCHANTABLE CONIFEROUS AREA. Designate in 5% classes e.g. 65%, 70% etc.)

9. Sample Trees

At the sample plot the following information should be completed for a representative tree for each of the coniferous species in the type:

Species - Record the species in captial letters re D.P.C.

Stump Diameter - Record the stump diameter of the representative species.

D.B.H. - Record the diameter breast height for the representative species to the nearest 0.1 inch.

Total Height - Record the total height of the representative species. A representative tree should be in the general canopy layer and should be an average of dominant and co-dominant coniferous trees for the entire type. Height should be accurately recorded in the space provided to the nearest 5 feet. Occasionally the top of the tree will be broken off and in this case the cruiser should estimate its former height.

Radial Growth - DBH last decade - The radial growth for the last 10 years should be taken in DBH and recorded in the space provided. Generally normal growth is about 8-12" height growth per year and .40" radial growth measured at DBH for the past 10 years. Do not bore leaning trees as they form uneven growth rings. Growth should always be bored from the west side of the tree.

10. Stand Average Age

The stand average age should be recorded in this space and should be based on the age of the representative trees of the overstory trees only. If an understory is present an average age of understory and overstory should not be recorded. The reason for this is that only the overstory trees should be programmed for cutting based on volume.

11. Maturity Class (Predominant Species)

In the case of mixed coniferous types the maturity class for the predominant species only should be checked.

Besides age of the representative overstory tree some indications of maturity are:

Overmaturity: Short, ragged crown or faded color, possibly some discoloration or crown morality.
Rounded, or flattened crown, poor leader growth.
Rough bark.
Large size, super dominance.
Physical defect - such as scars, broken tops, punk knots.

Maturity: Short crown of light color.
Rounded apex to crown.
Rough bark.
Large size - Generally crown should not be too ragged and physical defect should not be too noticeable in timber which is mature but not overmature. A mature tree should not generally be extremely pronounced in its dominance over other mature overstory trees.

Immaturity: Full healthy crown, dark green in color sharp apex to crown due to good leader growth.
Fairly smooth bark.
Medium size
Little or no physical defect.

Young: Full healthy crown, dark green.
Good leader growth.
Smooth bark.
Small to medium size.
Little or no physical defect.

The best way to develop an ability to judge maturity is to guess age on each and every tree you are going to sample before the age reading is taken, and then to compare your guess with the ring count.

(1970) Maturity Class Table: (Predominant Species in Total Number of Years)

e.g. 120 Year Rotation:-

	Overmature	Mature	Immature.	Young
Spruce	140 +	101-140	61-100	21-60
Pine	101 +	81-100	61- 80	21-60

12. Utilization Class

The correct designation for the entire stand should be checked.

(a) Saw Timber: For the purpose of a sawtimber Quota, this is defined as a minimum volume of 3,000 F.B.M. per acre in trees containing two or more 16' logs to a 6 inch top, to a 10" S.D. class in the case of a sawlog quota (8.7" D.B.H. and up)

(b) Pulp & Round Timber: Stands which are not merchantable for saw timber due to insufficient numbers of two log trees.

Timber which does not fall in the sawtimber or unmerchantable timber class should be included in this Pulp and Round Timber Class.

Also included in the Pulp and Round Timber Class will be those stands which have many small stems per acre and only a few scattered trees making up the 3,000 F.B.M. per acre minimum and where unreasonable damage to the residual stand would result in removal of this saw timber.

(c) Unmerchantable: Stands which are not economically suited for Pulpwood or Round Timber. These trees may have sufficient size but low volumes per acre prevail, or distance or relatively minor amounts precludes their marketing. These stands will be less than 3,000 F.B.M. per acre.

13. Condition Class

This is a key factor in Management Planning and its assessment is a reliable manner is thus essential.

Norm. (Normal) Refers to the normal or average stand which is relatively sound and healthy.

Stag. (Stagnant) Refers to stagnated stands which are generally sound and healthy but exhibit well below normal growth in height and/or diameter.

Dec. (Decadent) Refers to stand overstories in which over 30% of the trees exhibit physical defects in combination with overmaturity or poor health. A decadent stand is an old stand probably comprising a large number of trees with significant amounts of cull (+20% of gross volume unmerchantable).

D.P. (Damaged PhysicallY) Refers to stands damaged physically to appreciable degrees by such outside agencies such as fire, damage by heavy snow, winds and hail, flooding, previous logging, intensive explorative activities, etc.

D.I.P. (Damaged by Insects and Disease Refers to stands damaged by insect and or disease attacks to a significant degree. The insect or disease attack should be mentioned by name under remarks.

Condition classification generally determines the eventual harvesting sequence or other treatments in the development of the Quota Management Plan of a Management Unit.

14. Operability Class

SLA (Summer Logging Area) - Well-drained area with summer logging potential.

IA (Inoperable Area) - Inoperable due to topography, recreation and/or watershed limitations, etc.

WLA (Winter Logging Area) - That portion remaining after outlining the above two classes.

Operability Class herein combines topography (rugged, steep, medium, gentle); and drainage (retarded, normal, excessive); and logging chance (impossible, difficult, easy). Again this is a most practical factor in Management Planning and thus rates extra care in application.

15. Procedure for Rejecting a % of a Type for Inoperability (if only part of the type is inoperable)

Under natural forest conditions it is very seldom one finds that the total area of a type is inoperable. Usually only a certain part or percentage is actually inoperable and the rest is operable.

Therefore, the problem arises - how do we reject a % of a type? In other words, how can we account for the operable area and volume in a type that would otherwise be classed as inoperable?

The following example will illustrate the procedure to follow in such a case:

1. As the cruiser walks through type 63 (see attached sketch) he notices that part of the type is inoperable due to a steep ravine that crosses through the type. In the remarks he then notes that there must be some % deducted for the inoperable part of the type.

   The cruiser tallies his plot and in the OPERABILITY CLASS marks either summer or winter logging area but NOT inoperable. He should never mark inoperable unless the whole type can be classed as such.

2. When the cruiser returns to camp that night he carefully examines the air photos and from this and his field observation he marks on his map (and on the master map if available) that part of type 63 which is inoperable. This can be shown by hatch marks (////) or any other suitable method.

   He then makes sure that it is clear in the remarks that there is a deduction to be made in the number of acres.

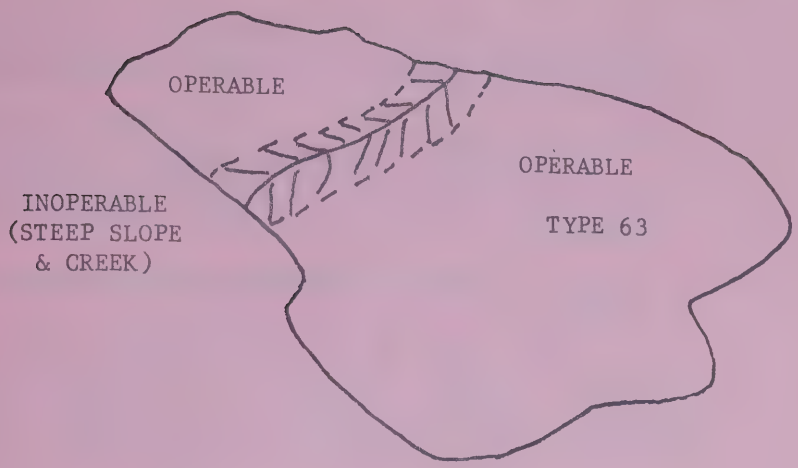
3. Before the Tally Sheets can be sent to the Data Processing Center, they must first be checked at the Forest Office. When this is being done, those Tally Sheets that state (in remarks) some percent must be deducted for inoperability should be set aside.

   The acreage deduction should then be calculated (from the map) by dot grid.

4. The new reduced acreage should then be entered on the Tally Sheet in the space marked H.O. Compiled Area in acres. In the example the H.O. compiled area was 100 acres but 20% was found to be inoperable; therefore 80 acres is now the new acreage figure to be entered on the Tally Sheet.

5. It is also necessary for the Forest Office to keep a record of these reduced acreages. This can be done by using the table on page 3.

In this way a permanent record by Townships of each Management Unit will be kept of the inoperable area and also the size of each area. The total inoperable figure will be included in the preparation of the respective Management Unit Plan.



H.O. COMPILED AREA = 100 Acres
OPERABLE AREA = 80 Acres
INOPERABLE AREA = 20 Acres
% DEDUCTION = 20%
NEW OR ADJUSTED ACREAGE = 80 Acres
(TO BE ENTERED ON TALLY SHEET AS H.O. COMPILED AREA IN ACRES)

MAN. UNIT	PLOT #	TYPE #	TWP. RGE. W OF _____	H.O. ACRES	INOPERABLE ACRES	% DEDUCT-ION	ADJUSTED ACREAGE
S1	1	63	69 16 5	100	20	20%	80

16. Total Gross Volume/Acre M. F.B.M. or M. Cubic Feet

The total gross volume/acre M F.B.M. or M. Cubic Feet should be recorded in this space from the back of the Tally Sheet. (See sample under item 27.3.6)

This item is the cruiser's estimate of the average gross volume per acre for all coniferous trees down to the 8.0 inch class. This includes all trees in the 8 inch class (lower limit 7.1 inches dbh and higher in 2" classes for the Form No. CS-TM05 F.B.M. Quota.

On the Cubic Foot Form No. CS-TM08 gross volume per acre is to be computed the same way as on Form No. CS-TM05. (See Cubic Foot sample under item No. 27.3.6)

Note: Form No. CS-TM08 (revised November, 1972) is designed to tally trees down to a 4" D.B.H. (e.g. fence posts). Trees in the 4" D.B.H. class will be tallied only if the minimum requirements are to a 3" top (4" D.B.H.). Where the minimum requirements

are 4.0" top and 5.0" D.B.H. the 4.0" D.B.H. class may be tallied but will be classed as unmerchantable.

Particular care must be taken in conglomerate types to express an average volume per acre based on timbered acreage only, with completion of the last item on the Tally Sheet from the aerial photographs.

17. Total Merchantable Volume/Acre M. F.B.M. or M.C.F.

The total merchantable volume per acre M F.B.M. or M.C.F. should be recorded in this space from the back of the Tally Sheet. The total merchantable volume per acre M. F.B.M. includes all volume in trees containing 2 or more logs at a 10 inch stump diameter. (8.7" D.B.H.).

The total merchantable volume per acre M.C.F. depend on the requirements of the area: pulpwood - 4.0" top and 5.0" D.B.H. minimum, fence posts, etc. 3.0" top and 4.0" D.B.H.

The computed average should be recorded if this is more representative.

18. Type Per Cent Conglomerate of Merchantable Coniferous Area

If conglomerate applies to the type a % should be entered here. After careful checking of the aerial photographs an estimate of the per cent of merchantable coniferous area supporting the type area should be recorded. Past experience has proven that this per cent entry has not been given sufficient thought and is usually over-estimated.

This item is most important when a volume estimate is being attempted on a conglomerate type. It is usually better in such types to base the average volume per acre estimate on the merchantable areas, and then to estimate from the photograph, the percentage of the total type area which is merchantable. Hence if a B4ASw type was composed of 40% solid spruce areas in the form of several pockets each averaging 20,000 F.B.M. per acre, while the remainder of the type was pure aspen, then notes would pertain to B4 Sw acres on 40% of the area.

Type percent should be to the nearest 5%.

A Conglomerate Type

A. As typed to 40 Acre Minimum Standard for Quota Reconnaissance Cruising

B. As typed to 10 Acre Minimum Standard (as in detailed type maps for timber licences etc.). Showing considerable acreages supporting completely non-merchantable cover.

19. Prism B.A.F. 10 or 20

Fill in the correct Prism B.A.F. used in taking the prism sample points.

20. Cull Factor Per Cent

A Cull Factor per cent for the Management Unit should be entered in this space.

This Management Unit % figure will be supplied by the Forest Forester as established by cull studies, detailed cruises or general knowledge of the area etc.

21. Definite Understory

Check the one which best describes the stand.

The overstory consists of those trees which make up the uppermost "crown layer" or crown canopy in the stand. The overstory may be dense, or quite sparse, of even or uneven height, and variations in age are to be expected.

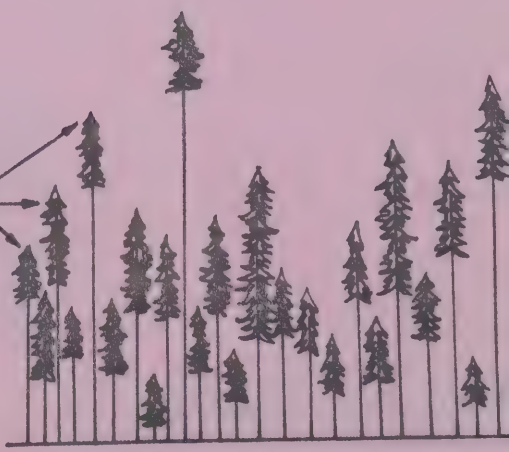
The understory, where there is one, consists of trees which are developing beneath the upper canopy. An understory can also be highly variable.

Illustrations of Relationship - Overstory to Understory

(a) Uniform* Overstory with Definite Understory

(b) Sparse Overstory - with Definite Understory

(a) Uneven* Overstory - with Definite Understory



(b) Uneven* Overstory with Intermixed lower level stems - No definite Understory

22. Understory Containing: Merchantable Volume and Unmerchantable Volume

Check the box which best describes the stand. If the stand contains merchantable volume notes should be made under remarks.

23. Remarks

This provides space for meaningful comments.

24. Head Office Compiled Area In Acres

Edmonton Head Office will provide as a service a listing of acreages for each type so that this space can be filled in prior to compilation.

27.3.3 Tallying "In" Trees on the Volume Table

1. Hold the prism vertical and horizontal. The base of the prism should be at right angles to the line of sight.

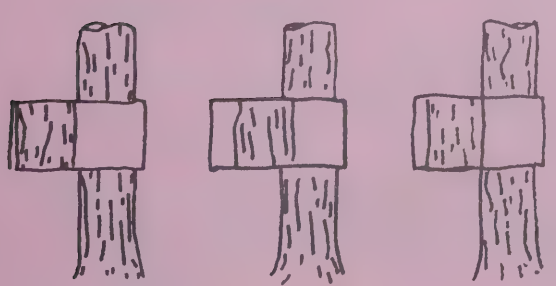
2. Hold the prism directly over the plot centre and pivot about this point.

3. For hidden trees the observer may be moved away from plot centre as long as the distance from the point to the tree in question is not changed.

4. For leaning trees rotate the prism so that its vertical axis corresponds with the centre of the stem of the tree.

5. The prism should be rotated to adjust for slope.

NOTE: Trees are either considered "in" or "out". There is no such thing as a borderline tree. Borderline trees should be measured with a tape to determine if they are "in" or "out". With a 10 Factor prism in order to be counted in, a tree must be located at a horizontal distance less than 2.75 times its diameter. This is very important as missing a few in or out trees greatly affects volume. The cruiser can stand at plot centre and holding the prism exactly over the point, call the trees to be tallied to the compassman who measures the diameters as the cruiser tallies them. Working in this way should provide reliable accuracy.



Out
Don't Tally

In
Tally

Measure with a tape to determine if tree is "in" or "out". There is no such thing as a borderline tree. It is either "in" or "out".

Using Prism to determine if tree is "in" or "out"

Determination of the status of borderline trees, where more than a 10 per cent slope is involved, requires that the prism be rotated around the line of sight by exactly the angle of inclination of the line of sight to correct for slope. If a wedge prism is rotated 90 degrees, the projected critical angle is reduced to zero. This indicates that rotating the prism reduces the critical angle so that the prism will reach out farther to pick up a given diameter, as previously discussed. The slope distance is greater than the horizontal distance, so an appropriate correction must be made. The top of the prism is curved so that as it is rotated the same relative orientation is retained.

27.3.4 Measuring Diameter Breast Height

Tree diameters are measured at breast height 4.5 feet above the average ground level. On a steep slope, D.B.H. is taken 4.5 feet about the ground on the uphill side of the tree. If the tree has an abnormal taper or growth at 4.5 feet, the measurement is taken above or below the abnormality and an estimate made as to what the D.B.H. would have been with normal taper. On leaning trees D.B.H. is taken at a point 4.5 feet along the bole. If the roots are above the ground, D.B.H. is taken 4.5 feet above the root color. D.B.H. is taken to the nearest one inch. For example a 14 inch class tree will include all diameters between 13.1 to 15.0 inches. (i.e. 2" diameter classes apply)

Tree calipers are used for measuring tree diameters. Two diameter measurements should be taken on each tree at right angles and averaged to determine diameter class. The tree caliper is the most accurate and suitable piece of equipment for measuring diameters when the timber is small and frequent measurements are necessary.

27.3.5 Possible Errors

In any cruise, regardless of method used, certain errors may creep in if the cruiser is not careful. The most common errors to avoid include:

1. Incorrect D.B.H. measurements
2. Inaccurate height measurements
3. Failure to measure all the trees in the plot or including borderline "out" trees into the tally.
4. Incorrect recording or measurements
5. Incorrect measurement of control lines
6. Arithmetic errors
7. "Air Calls" as they tend to over estimate
8. Non-standard coding

The amount of cruise that can be run in one day depends on topography, size and density of timber, weather, size of crew, experience, etc. It is far better to sacrifice number of plots per day for accurate and precise measurements.

27.3.6 Quota Reconnaissance Tally Sheet Examples

27.3.7 Form CS-TM05 (F.B.M. Quotas)

CS-TM05 Revised 72

A.F.S CONIFEROUS TIMBER QUOTA RECONNAISSANCE TALLY SHEET (FOR F.B.M. QUOTAS)

Date Nov 20 19 72

Cruiser John Smith

Compassman Joe Doe

Management Unit: A 2

Sec., Twp., Rge., Mer.: 3 15 16 4

Map Type: B2YSWPLLAW

Field Type: B3 SWPLLAW

Type No.: 2 4 5

Sample Trees

Species	Stump Dia.	D B H	Total Ht.	Radial Growth Last 10 Yrs	Total Age
SW	14.2	12.9	95	0.30	126
PL	12.6	11.4	95	0.30	105

Stand Ave. Age (Overstory only): 1 1 2

(6) MATURITY CLASS (Predominant Species): SW 4 | PL 8 | 14 + OM 8 | 101 + | C 40 W 9 | 8-100 | 6 OM 10 | 6 or

(9) UTILIZATION CLASS: 12 ✓ SAWTIMBER; 13 PULP & ACCOMPANYING SAWTIMBER; 14 UNMERCH. MEER

(12) UNDERSTORY: 23 PRESENT; 24 ✓ NOT PRESENT CONTAINS MERCH VOL.; 25 UNMERCH. VOL. 26 ✓

(7) TYPE AREA: 1 UNIFORM; 2 VARIABLE; 3 ✓ CONGLOMERATE

(10) PERABILITY CLASS: 1 SUMMER LOGGING AREA; 2 INOPERABLE AREA; 17 ✓ WINTER LOGGING AREA

(11) CONDITION CLASS: 1 NORMAL; 2 ✓ DAMAGED PHYSICALLY; 3 DECADENT; 4 STAGNANT; 22 DAMAGED I.B.D.

PLANNING COMPILATION FACTORS

(3) 1 1 8 TOTAL GROSS VOL./ACRE

(4) 7 5 TYPE % CONGL. OF MERCH. CONIF. AREA

(15) 9 9 MERCH. GROSS VOL./ACRE

(16) 7 5 CULL FACTOR %

(17) 1 2 0 NO. COMPILED AREA IN ACRES

(8) 1 0 PRISM B.A.F. 10 OR 20

REMARKS: Approx. 20% of Merch. Volume is Balsam Fir.

Cumulative Volume Tally - F.B.M. (Int. 5/16 Log Rule, No. of 16 Foot Logs to 6" D.I.B.)

DBH	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6
8	4 10 / 16 22	8 16 / 25 33	10 20 31 / 41 51 61	11 23 34 / 46 57 69							
10	5 10 / 16 21	8 16 / 23 31	10 20 29 / 39 49 59	11 22 33 / 44 55 66	14 28 42 / 56 70 84	17 34 51 / 68 85 102	20 40 60 / 80 99 119				
12	6 12 / 19 25	8 17 / 25 34	10 21 31 / 41 51 62	11 23 34 / 45 56 68	15 31 46 / 62 77 93	17 33 50 / 67 83 100	19 38 58 / 77 96 115	23 45 68 / 90 113 136			
14	6 12 / 18 24	8 16 / 24 32	10 20 30 / 40 50 60	11 22 33 / 44 55 67	14 28 42 / 56 70 84	17 34 51 / 68 85 102	21 41 62 / 82 103 124	24 49 73 / 97 121 146	26 51 77 / 103 128 154	27 54 / 81 108	29 58
16	5 10 / 16 21	7 14 / 21 28	9 18 27 / 36 44 53	10 21 31 / 42 52 62	15 29 44 / 58 73 88	16 32 48 / 64 80 97	20 39 59 / 79 98 118	22 44 66 / 88 110 132	26 52 79 / 105 131 157	28 56 / 84 112	30 61
18	4 8 / 12 16	6 11 / 17 22	8 15 23 / 30 38 45	9 18 28 / 37 46 55	14 27 41 / 55 69 82	15 31 46 / 61 76 92	19 39 58 / 78 97 117	22 45 70 / 89 111 134	24 49 73 / 98 122 147	28 57 / 85 114	32 65 / 97 130
			6 12 18 / 24 30 37	8 15 24 / 32 39 47	13 27 40 / 53 66 80	15 30 44 / 59 74 89	19 38 57 / 76 94 113	21 41 62 / 82 103 124	24 47 71 / 94 118 142	28 55 / 83 110	33 66 / 98 131
22					13 26 39 / 52 65 78	14 29 43 / 57 72 86	18 36 54 / 72 90 108	20 41 61 / 82 102 123	24 47 71 / 94 118 142	26 52 / 78 104	32 63 / 95 127
24					13 25 38 / 50 63 75	14 28 42 / 56 70 84	18 35 52 / 70 87 105	20 40 61 / 81 101 121	23 46 69 / 92 115 138	25 50 / 76 101	29 55 / 83 110
26					12 24 36 / 48 60 73	14 27 41 / 55 68 82	17 34 51 / 68 84 101	20 39 59 / 78 98 118	22 45 67 / 89 111 134	24 49 / 73 98	26 52 / 77 103
28								19 38 57 / 76 94 113	21 43 64 / 86 107 129	23 47 / 70 94	25 50 / 74 99
30								18 36 54 / 72 90 109	20 41 61 / 82 102 123	23 45 / 68 90	24 48 / 72 96
32								17 35 52	19 39 58	22 43	23 46
34								16 33 49	18 37 55	21 41	22 45
36								15 31 46	17 35 52	19 39	22 43
38								14 28 43	16 32 48	18 36	21 40

6 9
7 10
5 4

40 : 6.6 = 6.6 23

AVE "IN" TREES 46

MERCH. 51

12,000 FBM/ACRE

8 "IN" TREES MERCH.

18 : 6.6 Cum. Vol. Tally x B.A.F. x 10 Vol. T.F. = F.B.M./Acre

12,000 x x = 9.9 M FBM/ACRE ∴ TOTAL GROSS VOL./ACRE: 9.9 + 1.1 + .8 = 11.8M FBM/ACRE

↘ MERCHANTABLE VOLUME/ACRE

27.3.8 Form No. CS-TM08 (Cubic Foot Quotas)

CS-TM 08 (Nov.,1972)

A.F.S. CONIFEROUS TIMBER QUOTA RECONNAISSANCE TALLY SHEET
(FOR CUBIC FOOT QUOTAS)

Date Nov. 20, 19 72 Cruiser John Smith Compassman Joe Doe

Management Unit ① R 6 Sec., Twp., Rge., Mer. ② 3 3 9 1 7 5 Type Number ⑤ 4 6

Map Type ③ B 2 Y 5 W P L A W Plot Number

Field Type ④ B 3 S W P L A W

SAMPLE TREES	Species	Stump Dia."	D.B.H."	Total Ht.	Radial Growth Last 10 Years	Total Age
	SW	14.2	12.9	86	0.30	92
	PL	12.6	11.3	79	0.30	86

Stand Average Age (Overstory Only) ⑥ 9 4

⑦ Maturity Class (Sw & Pl Species)

80 Year Rotation: (Heavy Round Timber) — 1 OM 101+; 2 M 61-100; 3 IM 21-60; 4 Y 1-20

100 Year Rotation: (Multi-Product) — 5 OM 121+; 6 M 81-120 ✓; 7 IM 41-80; 8 Y 1-40

120 Year Rotation: (Multi-Product) — 9 OM 141+; 10 M 101-140; 11 IM 61-100; 12 Y 1-60

⑧ Type Area: 13 Uniform; 14 Variable; 15 Conglomerate ✓

⑨ Utilization Class: 16 Saw timber ✓; 17 Scragg; 18 Post; 19 Unmerchantable

⑩ Operability Class: 20 Summer Log Area; 21 Inoperable Area; 22 Winter Log Area ✓

⑪ Condition Class: 23 Normal ✓; 24 Damaged Physically; 25 Decadent; 26 Stagnated; 27 Damaged, Insects & Disease

⑫ Understory: 28 Present; 29 Not Present ✓

Contains: Merch. Volume 30; Unmerch. Volume 31

Planning Completion Factors

⑬ Total Gross Vol. M.C.F./Acre 24.3 ⑭ Type % Compl. of Merch. Coniferous Area 75

⑮ Merch. Gross Vol. M.C.F./Acre 19.7 ⑯ Cull Factor % 15

⑰ 10.0 Compiled Area in Acres 100 ⑱ Prism B.A.F. 10 or 20 10

REMARKS:

A.F.S. CUMULATIVE VOLUME TABLE FOR CONIFEROUS TIMBER
10's of Merch. C.F. 3.0" Top C.I.B., 10' S. Ht., Prism 10 B.A.F.
T.G. Honer Table FMR-X-5, 1967, of C.F.S. Modified by A.F.S., Nov 1972

DBH	VOLUME (10's of Cubic Feet) 30	40	50	60	TOTAL HEIGHT (Ft.) 70	80	90	100	110	120
4	⑤ 18, 27 / 36, 45, 54	12, 24, 36 / 48, 59, 71	15, 30, 45 / 60, 75, 89	17, 35, 52 / 69, 87, 104						
5	12, 24, 36 / 48, 60, 71	⑯ 31, 47 / 63, 78, 94	19, 39, 58 / 77, 96, 115	23, 45, 68 / 91, 113, 136						
6	13, 26, 39 / 52, 65, 78	17, 34, 51 / 68, 85, 103	㉑ 42, 63 / 84, 105, 126	25, 49, 74 / 99, 123, 148	28, 57, 85 / 113, 142, 170					
7	14, 27, 41 / 54, 68, 81	18, 36, 53 / 71, 89, 107	22, 44, 65 / 87, 109, 131	26, 51, 77 / 103, 129, 154	29, 59, 88 / 118, 147, 177	33, 66, 99 / 133, 166, 199				
8	14, 28, 42 / 55, 69, 83	18, 36, 54 / 73, 91, 109	22, 45, 67 / 89, 111, 134	26, 53, 79 / 105, 131, 158	30, 60, 90 / 120, 151, 181	34, 68, 101 / 135, 169, 203	37, 75, 112 / 150, 187, 224			
9	8	18, 37, 55	㉓ 45, 68	27, 53, 80	30, 61, 91	34, 68, 103	38, 76, 114	41, 83, 124		
10	6 / 7 / 10	74, 92, 110 / 18, 37, 55 / 74, 93, 111	90, 113, 135 / 23, 45, 68 / 91, 114, 136	106, 133, 160 / 27, 54, 80 / 107, 134, 161	122, 152, 183 / 31, 61, 92 / 123, 153, 184	137, 171, 205 / 34, 69, 103 / 138, 172, 207	153, 190, 229 / 38, 76, 114 / 152, 191, 229	165, 207, 248 / 42, 83, 125 / 167, 208, 250		
12	5 / 4	19, 37, 56 / 75, 93, 112	23, 46, 69 / 92, 115, 137	27, 54, 81 / 108, 135, 162	31, 62, 93 / 124, 155, 186	35, 69, 104 / 139, 174, 209	38, 77, 115 / 154, 192, 231	42, 84, 126 / 168, 210, 252	46, 91, 137 / 182, 228, 273	
14	40 ÷ 6 = 6.6 Merch. "IN" TREES/ACRE	23, 46, 69 / 92, 115, 138	27, 54, 81 / 100, 136, 163	31, 62, 93 / 124, 155, 186	35, 70, 105 / 140, 174, 209	39, 77, 116 / 154, 193, 232	42, 85, 127 / 169, 211, 253	46, 91, 137 / 182, 228, 274	49, 98, 147 / 196, 245, 294	
16	—	23, 46, 69 / 92, 115, 138	27, 54, 82 / 109, 136, 163	31, 62, 93 / 125, 156, 187	35, 70, 105 / 140, 175, 210	39, 77, 116 / 155, 193, 232	42, 85, 127 / 169, 211, 254	46, 91, 137 / 183, 228, 274	49, 98, 147 / 196, 245, 295	
18	18+23+27+62+70 +39 = 2390 C.F./Ac	23, 46, 69 / 92, 116, 139	27, 54, 82 / 109, 136, 163	31, 62, 94 / 125, 156, 187	35, 70, 105 / 140, 175, 210	38, 78, 116 / 155, 194, 233	42, 85, 127 / 169, 212, 254	46, 92, 137 / 183, 229, 275	49, 98, 148 / 197, 246, 295	
20	(8 Mer. "in" TREES)	—	27, 54, 82 / 109, 136, 164	31, 62, 94 / 125, 156, 187	35, 70, 105 / 140, 175, 210	39, 78, 116 / 155, 194, 233	42, 85, 127 / 169, 212, 254	46, 92, 138 / 183, 229, 275	49, 98, 148 / 197, 246, 295	
22	6.6 : 8 = X / 2390	—	27, 55, 82 / 109, 137, 164	31, 63, 94 / 125, 157, 188	35, 70, 105 / 141, 176, 211	39, 78, 117 / 156, 194, 233	42, 85, 127 / 170, 212, 255	46, 92, 138 / 184, 230, 276	49, 99, 148 / 197, 247, 296	
24	X = 1972 MERCH. C.F./ACRE			31, 63, 94 / 125, 156, 188	35, 70, 105 / 140, 176, 211	39, 78, 116 / 155, 194, 233	42, 85, 127 / 170, 212, 255	46, 92, 138 / 184, 230, 275	49, 98, 148 / 197, 246, 296	
26+	(850 ALBERTA TREE SAMPLE)			31, 63, 94 / 125, 156, 188	35, 70, 105 / 141, 176, 211	39, 78, 117 / 155, 194, 233	42, 85, 127 / 170, 212, 255	46, 92, 138 / 184, 230, 276	49, 98, 148 / 197, 246, 296	

∴ TOTAL GROSS VOL./ACRE = 19.7 + .9 + 1.6 + 2.1 = 24.3 M.C.F./ACRE

FORMULA: VMCF = {1/10} {0.9604 − 0.1660 F − 0.7868 F²} {D²[0.694 + (343.896/H)]} {10/0.5454 D²} Where F = (9/D²)(1 + 1/H)

NOTE: It is imperative that these Tally Sheets be filled out completed and correctly at all times. This means that each section of the Tally Sheet must be completed (even if there is no volume in the plot). If one section is left blank all the information on the Tally Sheet is rejected by the computer.

27.4 Part II - Coniferous Timber Quota Reconnaissance Compilation Procedures

27.4.0 Introduction

The Coniferous Timber Quota Reconnaissance compilation program is basically the preparation of a map color-coded to show different age classes for the merchantable timber; and an attachment sheet which summarizes volume information compiled by Township and Range. A Sample of the Coniferous Timber Quota Reconnaissance Attachment Sheet Form No. 56 Revised 1971 is appended.

Form No. TM 56 will be used for both F.B.M. and Cubic Foot only when hand compiling.

Both Forms CS-TM05 and CS-TM08 are now programmed for computer processing which eliminates using the attachment sheet.

The Coniferous Timber Quota Reconnaissance Attachment Sheet is intended to summarize all pertinent information from the Tally Sheet that is to be used in preparing the Management Plan. The Attachment Sheet is intended to compliment the map and provide further information which cannot be shown on the map for each type area and also serves as a form to systematically compile volume information by Township and Range. The Attachment Sheet is now being replaced by a computer print-out and therefore will be used only when hand compiling.

27.4.1 Completing the Coniferous Timber Quota Reconnaissance Attachment Sheet

The Attachment Sheet must describe only those merchantable operable type areas which have been inspected and as described on the Coniferous Timber Quota Reconnaissance Tally Sheet Form No. CS-TM05 or CS-TM08.

Where previous inspection (detailed cruises, inventory data, timber licences etc.) have provided adequate information the type area is considered to have been inspected for Quota Reconnaissance purposes and the types should be colored on the map and the volume information etc. should be transferred to the Attachment Sheet.

Note:

Types on Forest Cover Maps are numbered by Township commencing in Section 1 and progressing in increasing consecutive numerals through to Section 36. Type numbers do not extend to cover two townships. Numbering begins with number 1 in each township.

Acres for each numbered type found on the Forest Cover Maps are compiled by the Timber Management Branch, Head Office, Edmonton as a service and should be used to aid compilation procedures. Area is presently determined by a dot-grid system.

The Sub-total merchantable gross/net volume determined on the Attachment Sheet for each Township will yield a total merchantable gross/net volume for the entire Management Unit. This figure can then be used to compute an allowable cut for the area.

Basically the information gathered on the Coniferous Timber Quota Reconnaissance Tally Sheet must be compiled twice, i.e. by Township and Range and then by Cutting Blocks. Possibly sometime in the future the first compilation can be completed by a computer program in the form of a print-out sheet.

The duplication in compilation is inevitable as the Township boundaries are too large a unit to establish Cutting Block boundaries. A total merchantable gross/net volume must first be determined as the size of the cut blocks are related to the allowable cut. This part of

the reconnaissance cruise thus involves a major portion of the man hours required in the process. Each cut block should have sufficient volume of merchantable timber for at least 5 years of operations assuming the 50% removal basis of cutting.

The designation of cutting blocks should take into account such things as stand condition, maturity, stand location in relation to main roads and railway, topography, stand volumes and merchantability, logging economics, and the progression of deciduous timber cutting. Thus a practical sequence of cut blocks should be resolved.

Appendixed is a sample of a form that can be used in compiling information by compartments.

27.4.2 Coniferous Timber Quota Map Color Codes

On the map each type area found on the attachment sheet will be colored according to the following procedure to designate age classes.

1. Unmerchantable Type Areas - Unmerchantable types from a saw timber designation will be colored pink.

   The definition of merchantable saw timber is a stand containing a minimum volume of 3,000 f.b.m. per acre in trees containing 2 or more 16' logs to a 6" top.

2. Merchantable Type Areas - These areas both pine and spruce should be colored coded as follows:

   A. Coniferous Timber Predominately Spruce: -

			Mongol No.
Damaged physically, Insects & Disease -		Dark Blue	965
Overmature	140+	Light Blue	945
Mature	101 - 140	Dark Green	968
Immature	61 - 100	Light Green	948
Young	21 - 60	Olive Green	988

   B. Coniferous Timber Predominately Pine: -

Damaged Physically, Insects & Disease -		Black	949
Overmature	101 +	Brown	963
Mature	81 - 100	Brown Ochre	953
Immature	61 - 80	Orange	962
Young	21 - 60	Yellow	967

Note: The predominant species is as shown by the corrected field type.

The above maturity example applies to Management Units in the Boreal Region where the 120 year rotation is established.

In the Foothills Region, the 80,100 and 120 year rotations are assigned to specific Management Units through Head Office. The four Maturity Classes under each rotation appear on Form No. CS-TM08 (for Cubic Foot Quotas) and the condition and maturity color codes under 2A & B likewise apply.

TWP. ____ RGE. _____ W. _____ TH MERIDIAN

MANAGEMENT UNIT: _____

DATE: _____ 19 _____

COMPILED BY: _____

CHECKED BY: _____

Revised 1971

#	MAP TYPE	FIELD TYPE	STAND AVERAGE AGE	MAT. CLASS Y	MAT. CLASS IM	MAT. CLASS M	MAT. CLASS OM	CONDITION CLASS NORM.	CONDITION CLASS STAG.	CONDITION CLASS DEC.	CONDITION CLASS DAMP.	CONDITION CLASS D.I.D.	UTILIZATION CLASS S.T.	UTILIZATION CLASS PULP & ROUND TIMBER	UTILIZATION CLASS U.T.	OPERABILITY S.L.A.	OPERABILITY I.A.	OPERABILITY W.L.A.	MERCH. GROSS/NET VOL./ACRE M FBM/C.F.	% CONGL	CULL FACTOR	AREA IN ACRES	MERCH. GROSS/NET VOL. TYPE M FBM/C.F	REMARKS
S.T.																								

SPRUCE & PINE
TOTAL MERCH. GROSS/NET VOLUME
M FBM/C.F.

AREA IN ACRES

OM _____ _____

M _____ _____

IM _____ _____

Y _____ _____

SUB. TOTALS _____ _____

CUT BLOCK PRIORITY	OVERMATURE			MATURE			IMMATURE			YOUNG			TOTAL MERCH GROSS/NET VOLUME M FBM/MCF	TOTAL MERCH. ACRES	WEIGHTED AVERAGE CUTTING BLOCK AGE
	MERCH. VOLUME	ACRES	WEIGHTED AVERAGE AGE	MERCH. VOLUME	ACRES	WEIGHTED AVERAGE AGE	MERCH. VOLUME	ACRES	WEIGHTED AVERAGE AGE	MERCH. VOLUME	ACRES	WEIGHTED AVERAGE AGE			
SUB-TOTAL															

27.4.5 D.P.C. Compilation Procedure for Quota Reconnaissance Cruising

27.4.50 Introduction

Following is a brief outline of the procedure to be followed by each Forest in preparing Quota Reconnaissance Tally Sheets Form No. CS-TM05 and CS-TM08 for submission to this office for key punching and computer print-out.

Procedure is as follows:-

1. Quota Reconnaissance Tally Sheet Form No. TM 55 1971 has been revised into Form No. CS-TM05 1972 to facilitate fill in, key punching and checking. This form is for FBM Quotas only. It is essential that the same form be used to complete an entire Management Unit. In other words a Management Unit should not have a mixture of the two Quota Reconnaissance Tally Cards of Form Number TM 55 and CS-TM05.

   Quota Reconnaissance Tally Sheet Form No. CS-TM08 has recently been drafted and is also set up for data processing. This Tally Sheet is for Cubic foot Quotas and is to be used primarily in the Foothills Region.

2. The applicable Tally Sheets should be ordered primarily by Stationery Requisitions.

3. To avoid flooding the D.P. Centre, Quota Reconnaissance material should be submitted at a regulated input rate.

4. Successful compilation depends on no incorrect entires on the Tally Sheets. Also all boxes of the Tally Sheet must be filled out with a soft pencil if necessary so that each mark is clearly visible. If one box is left blank the whole Tally Sheet is rejected and the other information cannot be used.

   This necessitates very thorough checking at the Forest Office involved prior to forwarding directly to Mr. Floyd Bachor at the following address for key punching and computer processing:

   Computer Systems Section
   Room 507, Registration Division, Dept. of Lands & Forest
   Natural Resources Building
   Edmonton, Alberta

5. For progress and information purposes the Timber Management Planning Section (Attention: Forester) should also receive from the Forest involved a listing of those Townships and Ranges of Tally Sheets sent to D.P.C. for processing.

6. Transmittal Sheets Form No. CS-TM13 for Cubic Foot Tally Sheets and Form No. CS-TM10 for F.B.M. Tally Sheets are presently being drafted and are expected to be available in the very near future. Approximately fifty (50) Tally Sheets should accompany one (1) Transmittal Sheet. (Photocopies of proofs appended)

Note: As an interim measure Transmittal Sheet Form No. D.P.C. 18.001 may be used. The type of Tally Sheet (F.B.M. or Cubic Foot) should be noted and also the Forest and Management Unit from which they come.

7. The Forest Office should send a listing of Townships and Ranges to the Timber Management Branch (Attention: Forester i/c Forest Statistics Section) for those acreages that are required. This office will send the acreage compilation figures soonest following a numerical sequence.

8. Further checking of the D.P.C. Print-out will be required to determine if "unmerchantable area" is added into the total "area in acres" even if the type is unmerchantable and nil volume is shown. In other words, the unmerchantable type should record the number of acres but the acres and volume figures should not be recorded in the total.

Attached are the following:-

1. Form No. CS-TM05 - F.B.M. Quotas

2. Form No. CS-TM08 - Cubic Foot Quotas

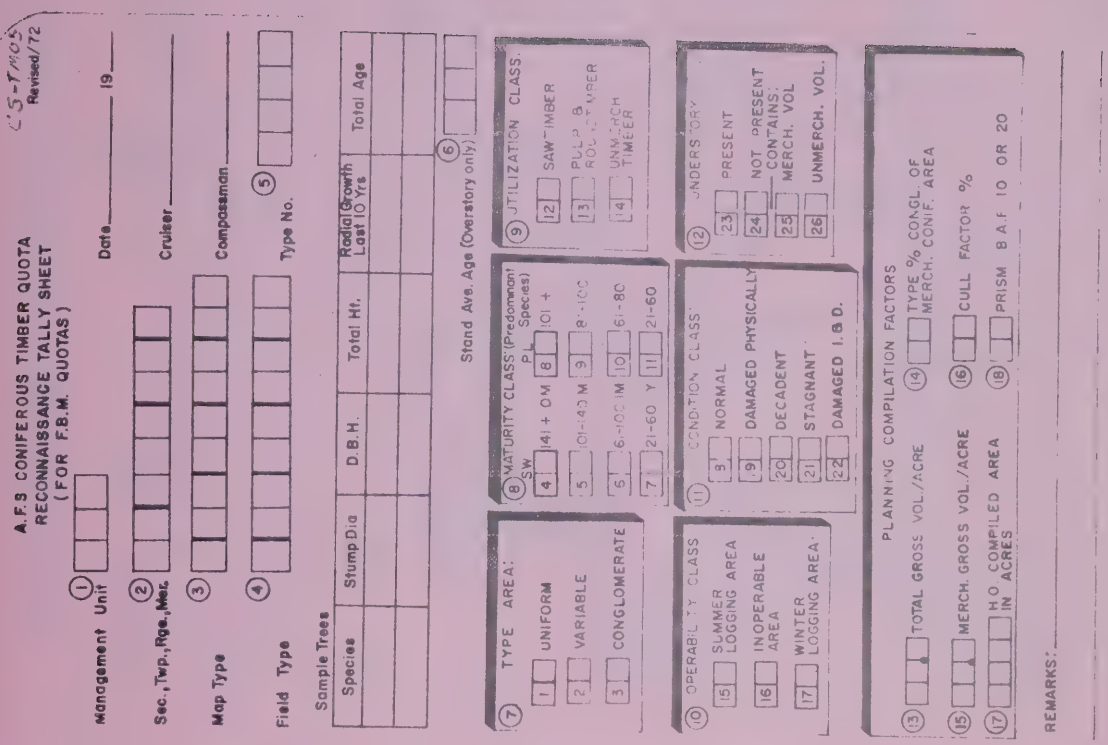
3. Form No. CS-TM10 - Transmittal Sheet for F.B.M. Tally Sheets

4. Form No. CS-TM13 - Transmittal Sheet for Cubic Foot Tally Sheets

5. Form No. TM 56 (1971) - Quota Reconnaissance Attachment Sheet - to be used for hand compiling only

6. Computer Print-out Sample - this takes the place of the attachment sheet Form No. TM 56 - example shown is for W2 Management Unit.

27.4.51



Cumulative Volume Tally - F.B.M. (Int. 5/16 Log Rule)

No. of 16 Foot Logs to 6" D.I.B.

DBH	1	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6
8	5 11 16 22	8 16 25 33	10 20 31 41 51 61	11 23 34 46 57 69							
10	5 10 16 21	8 16 23 31	10 20 29 39 49 59	11 22 33 44 55 66	16 32 48 64 79 95	17 35 52 70 87 104	20 40 60 80 99 119				
12	6 12 19 25	8 17 25 34	10 21 31 41 51 62	11 23 34 45 56 68	15 31 46 62 77 93	17 33 50 67 83 100	19 38 58 77 96 115	23 45 68 90 113 136			
14	6 12 18 24	8 16 24 32	10 20 30 40 50 60	11 22 33 44 55 67	16 32 48 64 80 96	17 34 51 68 85 102	21 41 62 82 103 124	24 49 73 97 121 146	26 51 77 103 128 154	27 54 81 108	29 58
16	5 10 16 21	7 14 21 28	9 18 27 36 44 53	10 21 31 42 52 62	15 29 44 58 73 89	16 32 48 64 80 97	20 39 59 79 98 118	22 44 66 88 110 132	26 52 79 105 131 157	28 56 84 112	30 61
18	4 8 12 16	6 11 17 22	8 15 23 30 38 46	9 18 28 37 46 55	14 27 41 55 68 82	15 31 46 61 76 92	19 39 58 78 97 117	22 45 70 89 111 134	24 49 73 98 122 147	28 57 85 114	32 65 97 130
20			6 12 18 24 30 37	8 15 24 32 39 47	13 27 40 53 66 80	15 30 44 59 74 89	19 38 57 76 94 113	21 41 62 82 103 124	24 47 71 94 118 142	28 55 83 110	33 66 98 131
	22				13 26 39 52 65 78	14 29 43 58 72 87	18 36 54 72 90 108	20 41 61 82 102 123	24 47 71 94 118 142	26 52 78 104	32 63 95 127
		24			13 25 38 50 63 76	14 28 42 56 70 85	17 35 52 70 87 105	20 40 61 81 101 121	23 46 69 92 115 138	25 50 76 101	28 55 83 110
			26		12 24 36 48 60 73	14 27 41 55 68 82	17 34 51 68 84 101	20 39 59 78 98 118	22 45 67 89 111 134	24 49 73 98	26 52 77 103
				28				19 38 57 76 94 113	21 43 64 86 107 129	23 47 70 94	25 50 74 99
					30			18 36 54 72 90 109	20 41 61 82 102 123	23 45 68 90	24 48 72 96
					32			17 35 52	19 39 58	22 43	23 46
						34		16 33 49	18 37 55	21 41	23 45
						36		15 31 46	17 35 52	19 39	22 43
							38	14 28 43	16 32 48	18 36	21 40

Cum. Vol. Tally x B.A.F. x 10 Vol. T.F. = F.B.M./Acre

27.4.52

CS-TM 09
(Nov.,1972)

A.F.S. CONIFEROUS TIMBER QUOTA RECONNAISSANCE TALLY SHEET
(FOR CUBIC FOOT QUOTAS)

Date _____, 19___
Cruiser _____
Compassman _____

① Management Unit
② Sec., Twp., Rge., Mer.
③ Map Type
④ Field Type
⑤ Type Number
⑥ Plot Number

SAMPLE TREES

Species	Stump Dia."	D.B.H."	Total Ht.	Radial Growth Last 10 Years	Total Age

Stand Average Age (Overstory Only) ⑥

⑦ Maturity Class (Sw.& Pl. Species)

80 Year Rotation: (Mainly Round Timber)
1 OM 101 +
2 M 61–100
3 IM 21–60
4 Y 1–20

100 Year Rotation: (Multi-Product)
5 OM 121 +
6 M 81–120
7 IM 41–80
8 Y 1–40

120 Year Rotation: (Multi-Product)
9 OM 141 +
10 M 101–140
11 IM 61–100
12 Y 1–60

⑧ Type Area:
13 Uniform
14 Variable
15 Conglomerate

⑨ Utilization Class:
16 Saw timber
17 Scragg
18 Post
19 Unmerchantable

⑩ Operability Class:
20 Summer Log Area
21 Inoperable Area
22 Winter Log Area

⑪ Condition Class:
23 Normal
24 Damaged Physically
25 Decadent
26 Stagnated
27 Damaged, Insects & Disease

⑫ Understory
28 Present
29 Nil Present
Contains:
30 Merch. Volume
31 Unmerch. Volume

Planning Compilation Factors:
⑬ Total Gross Vol. M.C.F./Acre
⑭ Type % Congl. of Merch. Coniferous Area
⑮ Merch. Gross Vol. M.C.F./Acre
⑯ Cull Factor %
⑰ H.O. Compiled Area in Acres
⑱ Prism B.A.F. 10 or 20

REMARKS: _____

A.F.S. CUMULATIVE VOLUME TABLE FOR CONIFEROUS TIMBER

10's of Merch C.F. 3.0" Top D.I.B., 10' S. Ht., Prism 10 B.A.F.
T.G. Honer Table FMR-X-5, 1967, of C.F.S. Modified by A.F.S., Nov. 1972

D.B.H.	VOLUME (10's of Cubic Feet) TOTAL HEIGHT/(Ft.)						USE AVERAGE FOR DIAMETER CLASS			
	30	40	50	60	70	80	90	100	110	120
4	9, 18, 27 36, 45, 54	12, 24, 36 48, 59, 71	15, 30, 45 60, 75, 89	17, 35, 52 69, 87, 104	— — — — — —	— — — — — —	— — — — — —	— — — — — —	— — — — — —	— — — — — —
5	12, 24, 36 48, 60, 71	16, 31, 47 63, 78, 94	19, 38, 58 77, 96, 115	23, 45, 68 91, 113, 136	— — — — — —	— — — — — —	— — — — — —	— — — — — —	— — — — — —	— — — — — —
6	13, 26, 39 52, 65, 78	17, 34, 51 68, 85, 103	21, 42, 63 84, 105, 126	25, 49, 74 99, 124, 148	28, 57, 85 113, 142, 170	— — — — — —	— — — — — —	— — — — — —	— — — — — —	— — — — — —
7	14, 27, 41 54, 68, 81	18, 36, 53 71, 89, 107	22, 44, 65 87, 109, 131	26, 51, 77 103, 129, 154	29, 59, 88 118, 147, 177	33, 66, 99 133, 166, 199	— — — — — —	— — — — — —	— — — — — —	— — — — — —
8	14, 28, 42 55, 69, 83	18, 36, 54 73, 91, 109	22, 45, 67 89, 111, 134	26, 53, 79 106, 131, 158	30, 60, 90 120, 151, 181	34, 68, 101 135, 169, 203	37, 75, 112 150, 187, 224	— — — — — —	— — — — — —	— — — — — —
9	— — — — — —	18, 37, 55 74, 92, 110	23, 45, 68 90, 113, 135	27, 53, 80 106, 133, 160	30, 61, 91 122, 152, 183	34, 68, 103 137, 171, 205	38, 76, 114 151, 189, 227	41, 83, 124 165, 207, 248	— — — — — —	— — — — — —
10	— — — — — —	18, 37, 55 74, 93, 111	23, 45, 68 91, 114, 136	27, 54, 80 107, 134, 161	31, 61, 92 123, 153, 184	34, 69, 103 138, 172, 207	38, 76, 114 152, 191, 229	42, 83, 125 167, 208, 250	— — — — — —	— — — — — —
12	— — — — — —	19, 37, 56 75, 93, 112	23, 46, 69 92, 115, 137	27, 54, 81 108, 135, 162	31, 62, 93 124, 155, 186	35, 69, 104 139, 174, 209	38, 77, 115 154, 192, 231	42, 84, 126 168, 210, 252	46, 91, 137 182, 228, 273	— — — — — —
14	— — — — — —	— — — — — —	23, 46, 69 92, 115, 138	27, 54, 81 108, 136, 163	31, 62, 93 124, 155, 186	35, 70, 105 140, 174, 209	39, 77, 116 154, 193, 232	42, 84, 126 169, 211, 253	46, 91, 137 182, 228, 274	49, 97, 147 196, 245, 294
16	— — — — — —	— — — — — —	23, 46, 69 92, 115, 138	27, 54, 82 109, 136, 163	31, 62, 93 125, 156, 187	35, 70, 105 140, 175, 210	39, 77, 116 155, 193, 232	42, 85, 127 169, 211, 254	46, 91, 137 183, 229, 274	49, 98, 147 196, 245, 295
18	— — — — — —	— — — — — —	23, 46, 69 92, 116, 139	27, 54, 82 109, 136, 163	31, 62, 94 125, 156, 187	35, 70, 105 140, 175, 210	38, 78, 116 155, 194, 233	42, 85, 127 169, 212, 254	46, 92, 137 183, 229, 275	49, 98, 148 197, 246, 295
20	— — — — — —	— — — — — —	— — — — — —	27, 54, 82 109, 136, 164	31, 62, 94 125, 156, 187	35, 70, 105 140, 175, 210	39, 78, 116 155, 194, 233	42, 85, 127 169, 212, 254	46, 92, 138 183, 229, 275	49, 98, 148 197, 246, 295
22	— — — — — —	— — — — — —	— — — — — —	27, 55, 82 109, 137, 164	31, 63, 94 125, 157, 188	35, 70, 105 141, 176, 211	39, 78, 117 155, 194, 233	42, 85, 127 170, 212, 255	46, 92, 138 184, 230, 276	49, 99, 148 197, 247, 296
24	— — — — — —	— — — — — —	— — — — — —	— — — — — —	31, 63, 94 125, 156, 188	35, 70, 105 140, 176, 211	39, 78, 116 155, 194, 233	42, 85, 127 170, 212, 255	46, 92, 138 184, 230, 275	49, 98, 148 197, 246, 296
26+	(850 ALBERTA TREE SAMPLE)				31, 63, 94 125, 156, 188	35, 70, 105 141, 176, 211	39, 78, 117 155, 194, 233	42, 85, 127 170, 212, 255	46, 92, 138 184, 230, 276	49, 99, 148 197, 246, 296

FORMULA: $VMCF=\left\{1/10\right\}\left\{0.9604-0.1660F-0.7868F^2\right\}\left\{D^2/[0.694+(343.896/H)]\right\}\left\{10/0.5454D^2\right\}$ Where $F=(9/D^2)(1+1/H)$

...ental
...S AND FORESTS

TIMBER MANAGEMENT BRANCH

TRANSMITTAL SHEET

THIS TRANSMITTAL SHEET TO BE USED ONLY FOR

CS-TMOS FBM

Quota Reconnaissance Tally Sheets

Forest Use:

Forest _____

Management Unit _____

Date:

Submitted to Head Office _____

Return Requested _____

THE ATTACHED DOCUMENTS ARE CERTIFIED CORRECT IN RESPECT TO THE TRANSACTIONS TO WHICH THEY RELATE

_____
ORIGINATOR'S SIGNATURE

Head Office Use:

Date:

To Data Control Section
Data Processing Centre _____

Received from Data Control _____

Returned to Forest _____

①		②	③
	I.F	Transaction No. OO	No. of Documents

_____
Authorized

...berta
...NDS AND FORESTS

TIMBER MANAGEMENT BRANCH

CS-TM 1...

TRANSMITTAL SHEET

THIS TRANSMITTAL SHEET TO BE USED ONLY FOR

CS-TM08 | CUBIC FOOT

Quota Reconnaissance Tally Sheets

Forest Use:

Forest _____

Management Unit _____

Date:

Submitted to Head Office _____

Return Requested _____

THE ATTACHED DOCUMENTS ARE CERTIFIED CORRECT IN RESPECT TO THE TRANSACTIONS TO WHICH THEY RELATE

_____

ORIGINATOR'S SIGNATURE

Head Office Use:

Date:

To Data Control Section
Data Processing Centre _____

Received from Data Control _____

Returned to Forest _____

①	LF	② Transator No.	③ No. of Documents
		00	

_____

Authorized

27.4.34

A. F. S. CONIFEROUS TIMBER QUOTA RECONNAISSANCE ATTACHMENT SHEET NO. _____

Form No. FS-35
Revised 1971

TWP. ____ RGE. _____ W. _____ TH MERIDIAN

DATE: _____ 19 _____

COMPILED BY: _____

MANAGEMENT UNIT: _____

CHECKED BY: _____

#	MAP TYPE	FIELD TYPE	STAND AVERAGE AGE	MAT. CLASS Y	MAT. CLASS IM	MAT. CLASS M	MAT. CLASS OM	CONDITION CLASS NORM.	CONDITION CLASS STAG.	CONDITION CLASS DEC.	CONDITION CLASS DAMP.	CONDITION CLASS D.I.D.	UTILIZATION CLASS S.T.	UTILIZATION CLASS PULP & ROUND TIMBER	UTILIZATION CLASS U.T.	OPERABILITY S.L.A.	OPERABILITY I.A.	OPERABILITY W.L.A.	MERCH. GROSS/NET VOL./ACRE M FBM/C.F.	% CONGL	CULL FACTOR	AREA IN ACRES	MERCH. GROSS/NET VOL. TYPE M FBM/C.F	REMARKS
.T.																								

SPRUCE & PINE
TOTAL MERCH. GROSS/NET VOLUME
M FBM/C.F.

AREA IN ACRES

OM _____ _____

M _____ _____

IM _____ _____

Y _____ _____

SUB. TOTALS _____

ID: LFTP0017
DATE: 720615

DEPT. OF LANDS & FORESTS
A.F.S. CONIFEROUS TIMBER QUOTA RECONNAISSANCE ATTACHMENT SHEET

MANAGEMENT UNIT: W 2 TOWNSHIP: 61 RANGE:20 WEST 5TH MERIDIAN

TYPE NUMBER	MAP TYPE	FIELD TYPE	STAND AVE. AGE	TYPE AREA	MATURITY CLASS	COND-ITION CLASS	UTILI-ZATION CLASS	OPERA-BILITY AREA	TOTAL GROSS ACRE	MERCH GROSS ACRE	PER CENT CONGL	CULL FAC-TOR	AREA IN ACRES	MERCH NET VOL. TYPE M FBM	
64	A3 AWSW	A4 AWSW	95	VARIA	IM	NORM	UNME	SUMM	2.1	2.1	0	15	22	0.0	
67	B4 SW	A3 SW	80	VARIA	IM	NORM	PULP	WINT	6.4	4.6	0	15	8	31.3	*
68	A3 SW	B3 SWAW	85	VARIA	IM	NORM	SAW	WINT	2.6	2.6	0	15	8	17.7	
69	B3 SW	B3 SWAWPL	85	UNIFO	IM	NORM	SAW	WINT	13.5	10.0	0	15	114	969.0	
70	C3 AWSW	B4 PLSWAW	130	UNIFO	OM	NORM	SAW	SUMM	12.2	12.2	0	15	44	456.3	
71	B4 SW	B4 PLSW	150	UNIFO	OM	DAMP	SAW	WINT	17.7	17.7	0	15	8	120.4	*
72	B3 SWPLAW	B4 SWAWPL	85	VARIA	IM	NORM	SAW	WINT	19.7	18.1	0	15	78	1200.0	
74	B3 AWSW	B4 SWAWPL	105	VARIA	M	NORM	SAW	SUMM	15.2	14.4	0	15	12	140.9	
75	A3 AWSW	A4 SWAW	105	CONGL	M	DAMP	SAW	SUMM	3.6	3.6	20	15	12	7.3	
76	B3 AWSW	B4 SWAW	120	CONGL	M	NORM	SAW	WINT	11.7	11.2	45	15	10	42.8	
79	B3 SW	B3 SWAWPL	95	UNIFO	IM	NORM	SAW	WINT	8.8	8.8	0	15	28	209.4	

MATURITY	FREQ-UENCY	MERCH NET VOL. TYPE M FBM	AREA IN ACRES
OM	2	576.7	52
M	3	197.0	34
IM	6	2427.4	258
Y	0	0.0	0
TOTAL:		3201.10	344

UTILI-ZATION	FREQ-UENCY	MERCH NET VOL. TYPE M FBM
SAW	9	3169.8
PULP	1	31.3
UNME	1	0.0
TOTAL:		3201.10

OPERA-BILITY	FREQ-UENCY	MERCH NET VOL. TYPE M FBM
SUMM	4	610.5
INOP	0	0.0
WINT	7	2590.6
TOTAL:		3201.10

COND-ITION	FREQ-UENCY	MERCH NET VOL. TYPE M FBM
NORM	9	3073.4
STAG	0	0.0
DECA	0	0.0
DAMP	2	127.7
DID	0	0.0
TOTAL:		3201.10

27.5 Part III - Coniferous Timber Quota Management Plan Preparation

27.5.0 Introduction

The foregoing Quota Reconnaissance Cruising and Compilation information is necessary in order to develop a Coniferous Timber Quota Management Plan. Appendixed to this Section is a draft outline that is to be followed in preparing the Quota Plan.

27.5.1 Coniferous Timber Quota Plan Example of A7 Management Unit Revised March, 1971

An example of a Coniferous Timber Quota Plan follows.